What are the attitudes of astronomers and astrophysicists regarding non-scientific cosmologies?

by Melanie Sticker-Jantscheff

This paper describes a small interview study into the attitudes of astronomers and astrophysicists regarding non-scientific cosmologies. Questions covered were: their motivation for doing science, their attitudes regarding religion and spirituality as representing non-science, and their opinions about astrology, based on the fact that the development of astronomy and astrology in the course of history is closely intertwined. The study sheds some light on how these astronomers and astrophysicists operate between scientific curiosity, with its occasional need for freedom from culturally imposed restrictions, to question existing assumptions about the nature of a research subject on one side, and the integration of research findings into a culturally meaningful context on the other. It also shows that attitudes regarding non-scientific world views are nuanced and multi-layered.

Introduction

An examination into the attitudes of astronomers and astrophysicists regarding non-scientific cosmologies, whereby cosmology is defined as an 'understanding of the organization and evolution of the universe', necessarily needs to take into account that no absolute definition of *scientific* versus *non-scientific* exists: The term *science* derived from the Latin word *scientia*, meaning 'knowledge', originally knowledge which could be gained through either experience, both practical as well as inner and subjective, or experiment.[1] It was not until the 19th century, that *scientific* mainly took on the meaning of a method perceived of as being applied by human beings as neutral observers towards

[1] Norriss S. Hetherington, 'Cosmology. Historical, Literary, Philosophical, Religious, and Scientific Perspectives', Routledge, New York and London, 1993 (2008), p. 3; Raymond Williams, *Keywords. A Vocabulary of Culture and Society*, revised edition, Oxford University Press, New York, 1976 (1983), p. 277, 278 [hereafter Williams, *Keywords*]

nature as external object and set in contrast to subjective areas like religion, art, psychology and values.[2] Despite this distinction, however, no consensus exists up to this day about what exactly 'the scientific method' is and, as Steven Shapin writes, '[d]isunity theorists doubt that there are any methodical procedures held in common ... which are *not* to be found in non-scientific forms of culture'.[3] Against this backdrop, I conducted a small interview study with five academic astronomers and astrophysicists. My questions covered their motivation for doing science, their attitudes regarding religion and spirituality as representing non-science, and their opinions about astrology, based on the fact that the development of astronomy and astrology in the course of history is closely intertwined.[4] This paper sheds some light on how these astronomers and astrophysicists operate between scientific curiosity with its need for freedom from culturally imposed restrictions, to question existing assumptions about the nature of a research subject on the one side, and the integration of research findings into a culturally meaningful context on the other. It also shows that attitudes regarding non-scientific world views are nuanced and multi-layered.

Literature Review

The question of what actually motivates scientists to do science has been the subject of academic research and can provide useful hints about the attitudes of scientists towards non-scientific areas of life.[5] Apart from the hypothesis that scientists work for money and status just like 'everybody else', Hagstrom, as well as Mulkay and Turner promoted recognition-exchange theory as the main force of motivation, whereas Gustin, based on Shils' theory of the charismatic nature of science, argues that science provides 'a link between an individual and the cosmos', thereby satisfying the need for meaningful order.[6]

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[2] Williams, *Keywords*, p. 279

[3] Fred Grinnell, 'Doing Science', *Knowledge, Technology, & Policy*, 15 (1) & (2), 2002, p. 205 [hereafter Grinnell, 'Doing Science']; Steven Shapin, 'Science', in *New Keywords. A revised Vocabulary of Culture and Society*, edited by Tony Bennett, Lawrence Grossberg and Meaghan Morris, Blackwell Publishing, 2005 (2012), p. 317

[4] Nicholas Campion, ' *A History of Western Astrology'*, Vol. 1, Continuum Books, London, 2008, pp. x-xi

[5] Bernard H. Gustin, 'Charisma, Recognition, and the Motivation of Scientists', *American Journal of Sociology*, 78 (5), 1973, pp. 1119-1134 [hereafter Gustin, 'Charisma']

[6] Warren 0. Hagstrom, *The Scientific Community*, Basic, New York, 1965; M. J. Mulkay and B. S. Turner, 'Over-Production of Personnel and Innovation in Three Social Settings.' *Sociology,* 5, 1971, pp. 47-62; both cited in Gustin, 'Charisma'; Gustin, 'Charisma'; Edward Shils, 'Charisma, Order, and Status', *American Sociological Review*, 30 (2), 1965, pp. 199-213 [hereafter Shils, 'Charisma']

Some older proponents of secularisation theory claim that an increase of scientific knowledge will gradually lead to a general decline of religion.[7] As Robert Wuthnow says, these scholars have 'tended to view science as an unquestionable description of fact', in contrast to religion which relies on belief without need of proof, resulting in the 'proverbial "warfare" between reason and faith'.[8] According to Wuthnow, there is evidence, however, to view science more as an activity dealing with 'a precarious reality', in need of setting itself apart from traditional, dogmatic and 'reality-maintaining' religious views.[9] Elaine Howard Ecklund has also challenged a simplistic understanding of secularisation theory with regard to the relationship between science and religion.[10] Ecklund draws on the sociological concept of boundary theory to argue that 'science and religion might actually overlap or influence one another' because scientists engage in 'negotiat[ing] boundaries' between the two fields.[11] This view contrasts Stephen Jay Gould's opinion that science and religion belong to 'non-overlapping magesteria'.[12] An additional perspective is offered by Fred Grinnell who adds art as a third means of human expression besides science and religion, in order to create a holistic world view.[13]

The discipline of 'Cultural Astronomy and Astrology' is located at the interface of science and religion - astronomy today being one of the natural

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[7] James Leuba, 'Religious Beliefs of American Scientists', *Harper´s Magazine* 169, 1934, p. 300 (cited in Elaine Ecklund and Christopher Scheitle, 'Religion among Academic Scientists: Distinctions, Disciplines, and Demographics', *Social Problems*, 54 (2), 2007, p. 291; [hereafter Ecklund and Scheitle, 2007]); Rodney Stark, 'On the Incompatibility of Religion and Science: A Survey of American Graduate Students', *Journal for the Scientific Study of Religion*, 3, 1963, pp. 3-20; Michael A. Faia, 'Secularization and Scholarship Among American Professors', *Sociological Analysis*, 37, 1976, pp. 63-74

[8] Robert Wuthnow, 'Science and the sacred', in *The sacred in a secular age*, edited by Phillip E. Hammond, University of California Press, 1985, p. 187, 194 [hereafter Wuthnow, 'Science and the sacred']

[9] Wuthnow, 'Science and the sacred', pp. 194, 199

[10] Ecklund and Scheitle, 2007

[11] Elaine Ecklund, Jerry Park and Katherine Sorrell, 'Scientists negotiate boundaries between religion and science', *Journal for the Scientific Study of Religion*, 50 (3), 2011, pp. 554-555 [hereafter Ecklund, Park and Sorrell, 'Scientists negotiate boundaries']; for boundary theory see Thomas F. Gieryn, 'Boundary-work and the demarcation of science from non-science: strains and interests in professional ideologies of scientists', *American Sociological Review*, 48 (6), 1983, pp. 781-795 [hereafter Gieryn, 'Boundary-work']

[12] Stephen Jay Gould, 'Nonoverlapping Magisteria,' *Natural History,* 106, 1997, pp. 16-22 [hereafter, Gould, Nonoverlapping Magisteria]

[13] Grinnell, 'Doing Science', p. 208-209

sciences and astrology considered a belief system in the widest sense.[14] As Nicholas Campion has shown, no consensus definition of what astrology actually is exists among practising astrologers, leading him to suggest that it might actually be better to speak of 'astrologies' in the plural.[15] By contrast, publications from scientists voicing their objections against astrology unanimously define astrology as an anachronistic belief in direct physical influence and therewith deterministic effect of planets and stars on human life on earth.[16]

Methodology

The present small case study was designed within the framework of the MA study course in Cultural Astronomy and Astrology at the University of Wales, Trinity Saint David. Drawing on my own professional background as a scientist, a biologist, with profound interests in seemingly non-scientific subjects, among them astrology, I sent a personally addressed e-mail to fifteen faculty members, thirteen men and two women, at four different universities/research institutions in Switzerland and Germany. I explained the scope of my research in a few sentences, attached my CV and also sent a link to the university's web page in case they might be interested in further information. Two professors immediately agreed to my interview request, one of them, upon a further request, also allowing me to contact some of his associates for an interview. I therefore contacted two postdoctoral fellows in this research group who both agreed to an interview. A third professor forwarded my e-mail to one of his postdoctoral fellows and this person then contacted me to schedule an interview. Two other professors answered my e-mail, one by saying that he would not be available for an interview, but without naming a specific reason and the other one by saying that he just started his position. Ten faculty members did not send any answer. In the end, I was able to schedule interviews with two professors, both around sixty years old, and three postdoctoral fellows, in their early thirties, all of them male and of three different European nationalities. Apart from the interview with R., which was conducted in English, the interview language was German. The semi-structured interviews took place within a period of three weeks in March and April 2013, were conducted face-to-face at the interviewees' respective

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[14] Nicholas Campion, *Astrology and Popular Religion in the Modern West: Prophecy, Cosmology and the New Age Movement*, chapters 8 and 9; Ashgate Publishing, 2012 [hereafter Campion, '*Astrology and Popular Religion*']

[15] Campion, *Astrology and Popular Religion*, p. 1; chapters 12 and 13

[16] Bart J. Bok and Margaret W. Mayall, 'Scientists Look at Astrology', *The Scientific Monthly*, 52 (3), 1941, pp. 233-244 [hereafter Bok and Mayall, 'Scientists Look at Astrology']; Bart Bok, Lawrence E. Jerome and Paul Kurtz, 'Objections to Astrology: A Statement by 186 Leading Scientists', *Humanist*, 35 (5), pp. 4-6; 1975 [hereafter Bok, 'Objections to Astrology']

workplaces and varied in length between thirty and forty minutes.[17] They were recorded with the permission of the interviewees and subsequently transcribed in full length.

Concerning my position as an insider and/or an outsider in relation to my target group, I was an outsider based on the fact that I did not know any of my interviewees before the interview and I approached them as a researcher. In addition, I did not expect my interest in astrology to be shared by my interviewees, based on the fact that I have never met any scientist with knowledge of the subject, added to my position as an outsider. On the other hand, I was also an insider, based on shared professional activity in the natural sciences and my own personal motivation for this research project, with its roots in the tension between science and non-science as outlined in the introduction. During the interviews I tried to avoid asking leading questions and instead encouraged interviewees to 'speak in their own terms' in order 'to discover the range of meanings given' to their subject of interest.[18] Lynda Measor calls this the possibility for interviewees to 'ramble' and Alan Bryman, in explaining Measor´s method, says 'rambling is interesting because it may reveal a matter of importance'.[19]

Findings and Discussion

In order to explore the attitude of astronomers and astrophysicists regarding non-scientific cosmologies, I considered it necessary to first take a look at their attitude regarding science, what was their motivation for becoming engaged in science, to continue to do science and their understanding of what science is. When I asked about their motivation, all interviewees referred back to their childhood and schooldays. They reported a fascination with as diverse things as the starry sky at night, 'the beauty of pure [mathematical] logic', space travel or science fiction adventures, but for all of them it was this fascination, and enthusiasm to further explore, which lead them to study physics.[20] B., a professor, who as a youth already had become an amateur-astronomer and 'even tinkered a telescope' to observe the night sky, said that being an astronomer for him is '[the fulfilment of] a childhood dream'.[21] He explained his fascination with 'a deep

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[17] See appendix for an outline of the interview questions

[18] Tony Walter and Helen Waterhouse, 'A Very Private Belief: Reincarnation in Contemporary England', Sociology of Religion, 60 (2), 1999, p. 189

[19] Lynda Measor, cited in Alan Bryman, *Quantity and Quality in Social Research*, Routledge, London, 1988, pp. 46-47

[20] [original text: 'die Schönheit der reinen Logik']

[21] [original text: 'und ich habe dann sogar ein Fernrohr gebastelt'; 'um so eigentlich meinen Bubentraum oder –wunsch zu erfüllen']

psychic predisposition or longing, which [he thinks] most people have ... but which some take more seriously than others' and, referring to Pythagoras' and Plato's cosmological models, expressed his growing conviction that 'there is a point to the ancient vision of a connection between sky and soul'.[22]

F., the second professor I interviewed, with his fascination for logic and mathematics from early on, had come to work in astrophysics in a roundabout way. He had grown up in a very industrial area 'where one could never see the stars', as he told me with a laugh, the first time he 'consciously [watched] an absolutely clear starry sky, where one had the feeling the stars are within one's reach', was at the age of thirty in California, while holding his first postdoctoral position.[23] He described this as 'an incredibly powerful experience' and went on telling me about how he sometimes enjoys arriving at his weekend house located in an area 'with absolutely no light pollution' and that this, had also lead him to learn about the constellations.[24] He described himself as a logical person and for him the fascination of the observational experience is inextricably linked with his scientific knowledge. He said, 'to watch and to know, this is a star of that category, and this is a red giant, and that one needs some other billions of years before it explodes, and this one will end one day as a planetary nebula'.[25]

Though B. was inspired to become a scientist by an emotional experience of interconnectedness, 'resonance' as he called it, and F. by his fascination for 'mathematics and mathematical proof and, if you so want, the beauty of pure logic', both connect their professional choice to something outside of science.[26] This finding lends support to Gustin's theory that scientific activity 'seems to or is thought to [bring a scientist] into contact with what is essential in the universe'.[27] In Gustin's opinion, 'what is essential' is 'a fundamental principle which has a

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[22] [original text: 'Und ich denke, das ist eine ganz ganz tiefe psychische Veranlagung oder Sehnsucht, die die meisten Menschen haben, …glaub ich, die dann halt gewisse Leute ernster nehmen oder eben dann versuchen, umzusetzen, …es ist etwas ganz Tiefes, denke ich, weil ich selbst immer mehr überzeugt bin, dass diese uralte Vision, dass Himmel und Seele zusammengehören…dass da was dran ist'.]

[23] [original text: ‚da hat man natürlich nie die Sterne gesehen'; ‚So richtig bewusst, so einen absolut klaren Sternenhimmel, wo man das Gefühl hat, man könnte die alle greifen, habe ich in Kalifornien gesehen, bei meinem ersten Postdoc im Jahre 1981.']

[24] [original text: ‚Und das war ein unheimlich beeindruckendes Erlebnis.'; ‚da gibt es keine light pollution, nix']

[25] [original text: 'und dann aber dahin zu gucken und zu wissen, das ist ein Stern dieser Gattung, und das ist ein roter Riese, und der braucht noch soundso viele Millionen Jahre, bis er explodiert, und der wird irgendwann mal als planetarischer Nebel enden']

[26] [original text: 'Mathematik und mathematische Beweise, und wenn man so will, die Schönheit der reinen Logik']

[27] Gustin, 'Charisma', p. 1124

determining, ordering significance', and it can be argued that both the feeling of resonance and the discovery of mathematical logic fulfil this criterion.[28] The thesis of a *functional* 'similarity between science and religion', based on the 'centrality of charisma to both', in Gustin's words, is therefore supported by the statements of these interviewees regarding their motivation.[29]

M., a postdoc, told me that apart from the fascination with 'astrophysical objects ... of course, as a schoolboy one has this dream to become famous one day and one of the most renowned researchers, but one realises quite fast that there are a lot of good people around and it is difficult to get on. ... There is certain disillusionment', which has no influence however on his general enthusiasm for the field of study.[30] According to Price, who found 'that most scientists ... actually publish very little [and] do not receive formal recognition ... from the scientific community', this postdoc's statement illustrates well the reality of working within the scientific community.[31] Still, these scientists continue to be motivated to do science. In this light, the recognition-exchange theory proposed by Hagstrom, Mulkay and Turner changes its meaning – publication and peer-recognition, though important for professional survival, are not always a *source* for motivation to do science. Instead, as Grinnell, who describes 'the everyday practice of science' so well, put it, they are important to gain '*credibility* – convincing peers that the new findings are correct'.[32]

O., another postdoc, stressed the importance of 'curiosity, to find something new, ... the freedom to follow one's interests' for his motivation.[33] He told me with enthusiasm that 'each answer leads to three more questions, it is a never-ending story' whereas the actual field of study is of lesser importance to him.[34] In this context, interestingly, two other postdocs reported a change in their understanding of what physics is during their studies. As R., the third postdoc I interviewed, said:

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[28] Gustin, 'Charisma', p. 1125
[29] Gustin, 'Charisma', p. 1131
[30] [original text: 'aber dann träumt man natürlich schon irgendwie als Schüler davon, dass man dann mal irgendwie, also, ganz bekannt wird, einer der weltweit wichtigsten Forscher wird, und so, und man merkt halt dann schon schnell, dass es eine Menge guter Leute gibt auf dem Gebiet und, ja, dass es halt auch sehr schwer ist, vorwärtszukommen, und das ist dann schon auch eine gewisse Ernüchterung']
[31] Derek John de Solla Price, *Little Science, Big Science*, New York, Columbia University Press, 1963, cited in Gustin, 'Charisma', pp. 1120-1122
[32] Grinnell, 'Doing Science', pp. 205
[33] [original text: 'die Neugier, etwas Neues herauszufinden… eine gewisse Freiheit, seinen Neigungen nachzugehen']
[34] [original text: 'Jede Antwort wirft drei neue Fragen auf, es ist eigentlich eine nicht endende Geschichte']

> I must say, it was not really easy, in the sense, that I was quite disappointed … One of the feelings I had, or one of the revelations I had … is, that actually nothing in physics is really exact. So whatever we do is an approximation of what happens in nature and we don't have exact descriptions of anything. So whatever we measure, whatever we think of things, are just approximations. This was a kind of drawback somehow, at the very beginning.

And M., who indicated that questions like 'where does humanity come from [and] how the cosmos came into being' had constituted 'a significant aspect' for his motivation to study physics, reported

> physics is one possibility to describe our environment, on a certain level, … but it is only a limited part of the whole, not reality as such, … it is only an image. … At the beginning of my studies this was not yet clear to me, back then I thought, ok, with physics you can explain anything and it provides the answers to all questions, but meanwhile I don't see it like this anymore.[35]

These statements provide evidence for Wuthnow's suggestion to view science as an activity dealing with 'a precarious reality' rather than 'an unquestionable description of fact'.[36] It can be argued therefore, that in the eyes of these scientists, a scientific cosmology is tentative and ever unfinished, in a sense it is under constant revision by the scientific activity. At the same time and causing some kind of tension, these statements also show the wish for final answers or, again in Gustin's words, the 'fundamental principle which has a determining, ordering significance'.[37] How this tension is met or if it is perceived at all, will influence a scientist's definition of and attitude towards 'non-science' and, as I would argue, depends on individual personality characteristics and life experiences.

How, then, do the astronomers and astrophysicists I interviewed relate to non-scientific cosmologies? I was aiming at as broad as possible an understanding of non-scientific cosmologies and not limiting it to mainly the Christian religion as the predominant European tradition. To this end and following the approach of Ecklund, I first asked my interview partners to provide me with their definition of

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[35] [original text: 'und ein wesentlicher Aspekt war da auch schon halt so…äh…ja…also, wo die Menschheit herkommt und wie unser Kosmos entstanden ist'; ‚Physik ist halt eine Möglichkeit, wie wir unsere Umwelt beschreiben können, auf einer bestimmten Ebene, … dass es auch nur ein beschränkter Teil ist davon und nicht die Realität an sich. …es ist ein Bild, das wir uns machen'; ‚das war mir am Anfang von Studium noch nicht so bewusst, das war noch nicht so relevant, da dachte ich, ok, mit der Physik kann man alles erklären, und die liefert die Antwort auf alle Fragen, die existieren, und das sehe ich eigentlich mittlerweile nicht so.']

[36] Wuthnow, 'Science and the sacred', p.194

[37] Gustin, 'Charisma', p. 1125

religion and spirituality and how they perceive the relation of these with science, and then for their personal attitude.[38]

There was a tendency among the interviewees to relate religion with structure, organisation and church institution, whereas spirituality was perceived as something personal and individual. R. called religion 'an old structure ... outdated, in a sense. And it has not made any attempt to get up to date, with the actual, within nowadays situations and social behavior. ... And they still want to impose some kind of rules which are not useful these days at all. [It is] even an industry'. This postdoc could not relate to the term spirituality either, but added that *ethics* 'is something mandatory and it should be to some extend the substitute for religion', suggesting the importance of a value system outside science.

O., who had made a distinction between religions in general and the related institutions, told me about the latter: 'to put it bluntly, these institutions just abuse [people's] spirituality for their own ends'.[39] He then defined spirituality as seeking answers to 'questions like "Who am I?", "Where do I come from?", "Where do I go?", "Why am I here?", "What is my responsibility?"', questions which he considered as just part of being human.[40] This postdoc argued that many people outside science perceive a conflict between religion and science based on a misunderstanding of science. 'Scientists - or science - do not want to answer any spiritual questions', but instead aim to understand the world in which we live.[41] He considered himself an atheist and spiritual in the sense mentioned above and could not see any conflict of the latter with being a scientist – a finding which is in line with Ecklund's description of the 'spiritual atheist'.

The same was true for F., who considered himself an agnostic and not deeply spiritual – 'for me it would simply be nice to perceive some abstract meaning...some logic...with this I would be content ... I don't need things wrapped in spirituality', as he put it – religious and spiritual questions in general clearly belong to a different realm than science.[42]

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[38] Elaine Howard Ecklund and Elizabeth Long, 'Scientists and spirituality', *Sociology of Religion*, 72 (3), 2011, pp. 259-260

[39] [original text: 'die Kirche, oder halt andere Weltreligionen, und das sind dann, also, in meinen Augen sind das dann halt, die Institutionen, also, um es böse zu sagen, die dann diese Spiritualität missbrauchen für ihren eigenen Selbstzweck']

[40] [original text: 'die Frage: Wer bin ich? Woher komme ich? Wohin gehe ich? Warum bin ich hier? Was ist meine Aufgabe?']

[41] [original text: ‚die Wissenschaftler, die Wissenschaft, möchte ja eigentlich gar keine Antworten auf diese spirituellen Fragen geben, sondern sie möchte Antworten auf die Welt, in der wir leben']

[42] [original text: 'für mich wäre schön, ´nen Sinn zu sehen…und ´ne Logik…und dann wäre ich zufrieden... Muss nicht noch ´ne Spiritualität drumrum sein.']

These two interviewees' opinions are therefore in agreement with Gould's theory of 'non-overlapping magesteria': no conflict but also no overlap between religion or spirituality and science is perceived because one is dealing with separate levels of being.[43] For B., however, his knowledge that the cosmos outside - stars, planets, galaxies – is composed of the same physical material as human beings on earth, gives rise to what he names 'resonance [which is] a form of spirituality [and] in complete accordance with ancient [Greek] philosophy'.[44] In contrast to my other interview partners who, to the extent that they add importance to it, keep their search for values or meaning confined to their private lives, this professor engages in creative public expression of both his scientific and non-scientific interests. A few years ago, he published a book about his view on the analogies between the medieval world view, as it was masterfully narrated by the medieval Italian poet Dante Alighieri in his 'Divine Comedy', and modern scientific cosmology.[45] He also regularly gives interdisciplinary public lectures and seminars touching on religious and spiritual themes, one of which I attended shortly after our interview. When, during the interview, I asked him to tell me about his motivation for his non-scientific engagement, he referred to the 'freedom to create a new world view, because a world view is nothing fixed' and the prevailing world view for him seems to be a remnant from the 19th century.[46] He added that he is aware of doing this as a philosophical lay person, 'it should be the task of philosophy, but somehow they don't do it, maybe they don't have enough scientific understanding, or they don't dare'.[47] On the other hand, he also emphasised that his book is neither a scientific nor scholarly work, but that he 'had used scientific knowledge as starting material to create something', in the

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[43] Gould, 'Nonoverlapping Magisteria,' pp. 16-22

[44] [original text: ‚diese Resonanz, …, das ist für mich schon eine Form der Spiritualität, auch das ganz im Einklang mit antiken Meinungen und Philosophie, dass es diesen Zusammenhang gibt.']

[45] Bruno Binggeli, 'Primum Mobile', Ammann Verlag, Zürich, 2006; Bruno Binggeli, 'Kosmische Klänge – Von der Sphärenmusik zum Urknall und zurück', *Hertensteiner Begegnung*, Hertenstein, 23./24. March 2013, to be found on http://www.brunobinggeli.ch/mundwerk.html (accessed on 18 April 2013)

[46] [original text: 'und ich habe ja auch diese Freiheit mir genommen,…, man darf sich ein neues Weltbild daraus bilden,…, dass das gängige Weltbild, das wir haben, eigentlich nichts fixes ist']

[47] [original text: 'das wäre eigentlich die Aufgabe der Philosophie, aber die machen es irgendwie nicht, weil sie vielleicht die Naturwissenschaft zu wenig verstehen, oder sie sich nicht getrauen']

sense an artist would do.[48] It can be argued therefore, that for this professor, science and non-science, let this be religion or spirituality, do not belong to 'non-overlapping magesteria', but can be combined and expressed through creative and artistic activity.

Grinnell explained the 'artistic attitude', in contrast to science's quest for credibility and religion's for truth, in paraphrasing Fineberg, as 'the individual offers through art his or her momentary vision of the world'.[49] According to Grinnell, 'a single individual can practice the world as science, religion, or art depending upon the attitude that he or she brings to the project' and should aim at, as Niels Bohr suggested according to Grinnell, 'complementarity', accepting the different approaches '*as they are*, creating a state of holistic, dynamic tension'.[50]

Coming to the last topic covered during my interviews, I was especially curious to learn about astronomers' and astrophysicists' opinions and attitudes regarding astrology, since even among practising astrologers, no consensus exists as to what astrology actually is and some rather polemical attitudes have been published by scientists.[51]

When asked what they associate with the term astrology, interviewees mentioned the horoscope, newspaper sun-sign columns, astrology TV-shows and the idea that 'the stars influence human life on earth'.[52] The opinion that astrology is based on a belief in direct physical influence from stars and planets on human life and the lack of any scientific evidence for such a belief, was the main reason for my interview partners to dismiss astrology as a subject worthy of investigation. F. mentioned the phenomenon of the precession of the equinoxes caused by the movement of the earth's rotational axis as proof that astrology is based on false assumptions. Three of my interview partners speculated about the possibility that instead of the constellations, it might be the influence of the seasons, weather and temperature, during the first few months of life that cause perceived similarities of character in people born at the same time of the year. As to the reasons why astrology, understood as believing in the advice and

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[48] [original text: 'freieren Umgang mit naturwissenschaftlichen Erkenntnissen. Man kann etwas damit machen, das machen Künstler sowieso, die nehmen das quasi als Material, als Stoff, mit dem sie was machen ']

[49] J. Fineberg,, '*Art Since 1940: Strategies of Being*.', Harry N. Abrams, Inc. New York, 1995, cited in Grinnell, 'Doing Science', p. 208

[50] Niels Bohr, 'Unity of human knowledge [1960].', in *Philosophical Writings of Niels Bohr Volume III*, Ox Bow Press, Woodbridge, CT, 1987, pp. 8-16, cited in Grinnell, 'Doing Science', p. 208-209, original italics

[51] Campion, '*Astrology and Popular Religion*', p. 1; Bok and Mayall, 'Scientists Look at Astrology'; Bok, 'Objections to Astrology'

[52] [original text: 'der Einfluss der Sterne auf die Menschen auf der Erde']

predictions of sun-sign columns or astrology TV-shows, is popular, the main reason speculated about, was that people like to know the future because it gives them a feeling of security. 'For normal people, it is easier to understand astrology than astronomy', and people are gullible, as R. said, mentioning a paper by Bertram Forer.[53]

Though the existing practice of astrology, as it appears to these astronomers and astrophysicists, cannot be taken seriously, B. told me that he '*does* take seriously the motivation to do it', because in his opinion, it is rooted in the ancient Greek idea of the interconnectedness of everything within the cosmos, something of which he is convinced of himself.[54] In O.'s opinion, in general, 'a scientist actually should not regard things as nonsense before knowing anything about them'. Regarding the polemics against astrology as being a danger, with which neither he nor the other interviewees were familiar, he suspected power games as being the reason behind it, an idea that makes sense in the light of Thomas Gieryn's study on 'Boundary-work and the Demarcation of Science from Non-science'.[55]

My interviewees' opinions regarding astrology were mainly based on their impression that astrology is about the belief in physical influence of the stars and planets on human life on earth, a concept that, as Campion notes with some surprise, is also prevalent among a high percentage of practicing astrologers.[56] As current scientific knowledge does not provide any explanation for this idea and rather disproves it, in my opinion it is understandable that astronomers and astrophysicists dismiss it as an outdated concept. In addition, such an understanding of astrology with its inherent determinism and the need to believe in it, in the eyes of the scientists I interviewed, can only be attractive to people who either cannot or do not want to think – whereas thinking, that is questioning assumptions, is a most important activity for a scientist.

These findings, I would argue, point to the core problem: astrology lacks credibility among the scientists I interviewed, because they have no knowledge about on what other theories people using it base their practice, even though a

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[53] Bertram Forer, '*The Fallacy of Personal Validation: A Classroom Demonstration of Gullibility*', 1949, pp. 118-123

[54] [original text: ‚aber was ich ernst nehme, ist eben quasi die Motivation dazu, weil, das ist dann wieder dasselbe, nämlich, dass wir verbunden sind mit dem Himmel']

[55] Gieryn, 'Boundary-work'; [original text: ‚Also, für einen Wissenschaftler, der sollte eigentlich nicht sagen, das ist Quatsch, ohne davon eine Ahnung zu haben.']

[56] Campion, '*Astrology and Popular Religion*', p. 182

variety of theories exist.[57] Campion mentions definitions of astrology as 'a psychological tool', 'a religion', 'a healing art', to name just a few.[58] Brady describes some astrologers as those whose beliefs are deeply embedded in classical philosophy, as well as others, who might 'seek to delude their victims'.[59] Only B. was familiar with another concept of astrology, namely 'an astrology ... which is not based on influence but rather on synchronicity in terms of C. G. Jung's understanding', and one, as he carefully admitted, he 'might be able to take seriously'.[60]

Based on Grinnell's analysis, gaining credibility for scientists is of major importance in the scientific process and their attitude regarding astrology, if not simply seen as a system one needs to believe in, it can be argued, is in no way different from their attitude regarding any novel or yet unknown scientific theory: upon first encounter it will be met with skepticism.[61]

Conclusion

This paper presents findings I obtained within the framework of a small interview study among five academic astronomers and astrophysicists, examining their motivation to do science and their attitude regarding non-scientific cosmologies as represented by religion, spirituality and astrology. I would like to emphasise that no generalising conclusions can be drawn from such a small study, all the more, that no information is available as to the motives of the large group of non-responders to my initial request for an interview. Nonetheless, qualitative results as obtained from a study like this one do provide valuable information for potential further research, because each person can be seen as exemplary for a larger group of individuals.

The findings presented support Gustin's argument of a functional 'similarity between science and religion' as a search for an ordering principle, an argument based on Shils' theory of the charismatic nature of science.[62] Furthermore, they illustrate the tension between the scientific enterprise, which requires freedom from culturally imposed restrictions to challenge established assumptions about the nature of things, and the need for a meaningful context

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[57] Campion, '*Astrology and Popular Religion*', p. 178; Bernadette Brady, 'Theories of Fate among Present-day Astrologers', PhD-Thesis, University of Wales Trinity Saint David, School of Archaeology, History and Anthropology, 2011, p. 285-296 [hereafter Brady, 'Theories of Fate']

[58] Campion, '*Astrology and Popular Religion*', p. 178

[59] Brady, 'Theories of Fate', pp. 296-297

[60] [original text: ‚die Form der Astrologie, die ich noch ernst nehmen kann, ist die, die eben nicht von einem Einfluss spricht, sondern von Synchronizität, im Sinne von C.G. Jung']

[61] Grinnell, 'Doing Science', p. 206

[62] Gustin, 'Charisma', p. 1131; Shils, 'Charisma'

and reliable structures within to live one's life. This is in line with Wuthnow's thesis of science dealing with a 'precarious reality'.[63] The astronomers and astrophysicists I interviewed objected to fixed or non-disputable world views, as, in their eyes, represented by some forms of religion and also astrology, but did not dismiss individual forms of spirituality in general. Thus, their attitude to *non-scientific* cosmologies depended on their personality and, presumably, life experiences, and in general was characterised by a reflective and nuanced approach.

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[63] Wuthnow, 'Science and the sacred', pp. 194, 199

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