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## Five steps for astronomers to communicate climate change effectively

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## 4 Five Steps for Astronomers to Effectively Communicate Climate

- 5 Change
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- 7 Astronomers are trusted voices in the communication of science; our community should resist
- 8 inundating people with facts and figures but use its advantage to encourage the public to listen to
- 9 climate-change experts and encourage the need for urgent cross-sectoral systemic change.

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14 Climate change is one of the most serious challenges facing our planet and we are increasingly 15 experiencing its dire effects with soaring temperatures, wildfires, floods and droughts. Within astronomy there is growing recognition of the urgency of the situation, the profession's impact on it, 16 and the need to communicate outside of the academy<sup>1, 2, 3</sup>. Scientists are highly trusted by the public 17 and tend to be seen as independent and non-controversial<sup>4</sup>. Astronomers are particularly well-18 19 placed to communicate on climate change given that the exciting nature of their subject often gives 20 them a platform in the media and the ability to reach out to very large numbers of people through a 21 variety of public outreach events around the globe. Astronomy offers many entry points to talking about climate change, from the climate history of the terrestrial planets to the notion that there is 22 no alternative planet for humans to live on: there is no Planet B<sup>3</sup>. We argue that there is a real 23 24 window of opportunity for astronomers to engage with the topic and weave climate change into 25 their public engagement activities. There is a large body of research in science communication and 26 environmental communication that can inform practice in the astronomy community and this article 27 summarises key findings.

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### 1. Tell a Story

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31 Effective climate change communication requires two-way dialogue and strong narratives. Telling stories enables audiences to make sense of complex issues and human-interest narratives tend to be 32 more memorable than numbers or graphs<sup>5</sup>. Best-practice guides on climate change communication 33 recommend emphasising scientific consensus while carefully explaining how a degree of uncertainty 34 35 is present in all scientific work<sup>6</sup>. Metaphors can influence people's attitudes to climate change and 36 strong visual images and analogies should be relatable and, where possible, include people<sup>7</sup>. When 37 crafting stories, however, it should be considered that the language and terminology used by 38 scientists may not be shared by the public and can add to confusion about the issues<sup>5, 8</sup>. As 39 Somerville and Hassol point out: "Scientists typically fail to craft simple clear messages and repeat 40 them often. They commonly overdo the level of detail, and people can have difficulty in sorting out 41 what is important. ... Many words that seem perfectly normal to scientists are incomprehensible 42 jargon to the wider world. And there are usually simpler substitutes." (2011: 50) A good example of

43 this is the use of the word 'theory', which can be interpreted by the public as a mere hunch or speculation. A better choice of terminology would be 'scientific understanding'<sup>5</sup>. While language 44 needs to be handled carefully in any climate communication, astronomers hold an advantage in that 45 46 many projects naturally instil a sense of awe. Observations from the Copernicus Sentinel-5P satellite 47 provided striking images charting the dramatic reduction in nitrogen dioxide concentrations as 48 COVID-19 restrictions were applied across Europe (Figure 1). Topics such as exoplanet exploration, 49 habitability and atmospheric composition can also act as bridges to reflect on human planetary 50 needs. 51

Figure 1 | Nitrogen dioxide concentrations over Europe. These images use data from the
Copernicus Sentinel-5P satellite to compare polluting nitrogen dioxide concentrations in March-April
2019 with the same period a year later, when pandemic restrictions were keeping many Europeans
at home. Credit: ESA.

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### 2. Make it Relevant

58 Connecting to what matters to the audience is key, as is dynamic co-production of knowledge 59 through dialogue. Despite increasingly experiencing the impact of climate change, it is still often 60 perceived to be a psychologically distant and abstract issue. Citizens can be readily engaged with 61 climate change through local environmental issues or meteorological conditions (e.g. air quality, flooding), and linking to immediate and personally relevant issues<sup>1,9</sup>. Participants in a study 62 examining citizens' accounts of climate change in Brazil, South Africa and China found that they 63 overwhelmingly framed their accounts in the context of locally salient issues<sup>10</sup>. Effective 64 communication of climate change adaptation needs to highlight that climate change is currently 65 66 visible at local levels. It should allow individuals to emotionally connect to the impacts experienced, particularly in situations in which they are psychologically distant<sup>11</sup>. Photography and film can be 67 important tools here. In astronomy, many observatories operate in remote and fragile natural 68 69 environments where resource use can be an evocative issue. Addressing environmental 70 sustainability through community engagement can be an important step in ensuring that 71 astronomical pursuits also recognise local impacts.

### 72 3. Tailor the Message

73 Providing people with more knowledge will not fix the problem. Communicators have often assumed 74 that the problem, in this instance climate change, is largely one of a deficit in knowledge and 75 understanding and that communicating the science will encourage attitudinal and behaviour change. 76 Recent research involving interviews with astronomers suggests that the community tends to view the public as homogenous with multiple deficits in knowledge<sup>12</sup>. There is a danger here that the 77 78 information deficit model is applied, based on the assumption that providing people with greater 79 information and explanation will move them to act. However, a long history of interdisciplinary 80 science communication research demonstrates that messages need to be tailored to the specific audience<sup>13, 14</sup> with recognition of communication as a two-way process. The same message is likely 81 to be received differently by different audiences and effective climate change communication needs 82 to be targeted while resonating with audience values and everyday lives<sup>15</sup>. Attitudes to climate 83 change are shaped by socio-political values and people tend to use their political and cultural 84 orientations to filter information on the issues<sup>5, 16</sup>. While people hold a variety of sometimes 85 86 conflicting values, research shows that people who identify with self-transcendent values (such as 87 benevolence and loyalty), and who exhibit high levels of altruism, are more likely to engage in 88 sustainable behaviour. By contrast, those who identify with self-enhancement values (such as personal ambition and materialism) are more likely to be sceptical about climate change and less 89 likely to exhibit high levels of concern<sup>16</sup>. A substantial body of research demonstrates that those 90

holding right-of-centre political views tend to be less concerned, more sceptical, and less receptive 91 92 to climate-change messaging. Focus group research undertaken in the UK suggests that in order to 93 engage such audiences it is best to frame energy efficiency in terms of avoiding waste rather than 94 the more contentious concept of preventing fuel poverty. Moreover, framing climate change in this 95 way also has broad appeal for those from opposing political perspectives whereas using a justice 96 frame that works well with left-of-centre audiences tends to alienate right-of-centre individuals<sup>16</sup>. In 97 addition to tailoring communication to specific demographic groups and according to political 98 ideology and cultural orientation, it needs to be relatable and accessible with a clear storyline. As 99 non-climate experts, astronomers can play a key role as scientifically aware and trusted voices. It is 100 not necessarily about explaining all the details of climate change, but showing that as scientists 101 astronomers trust and accept the expertise of climate scientists.

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### 103 4. Focus on Solutions

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It is imperative that climate change communication is solution-focused. Efficacy is crucial – the belief 105 106 that it is possible to do something, and if you do something it will make a difference. Research shows that doom-and-gloom messaging is often counter-productive and tends to leave people feeling 107 108 apathetic, despondent and disempowered<sup>14, 17</sup>. Fearful messages can mobilise people but they need to be combined with clear solutions that can be adopted<sup>17</sup>. This is particularly pertinent when 109 110 considering that individuals have been shown to have a 'finite pool of worry' and too much focus on 111 negative impacts can turn them off. As Moser and Dilling observe: "... risk information and fear-112 evoking images should be limited and always be combined with messages and information that 113 provide specific, pragmatic help in realizing doable solutions. ... Importantly, communicators must 114 establish a sense of collective response, especially by people in like social and cultural groups." (2011: 165)<sup>18</sup>. Astronomy projects often have unique qualities in this respect, with many operating 115 on an international level, holding strong public appeal and transcending cultural divides. While 116 117 individual behaviour change is important, systemic change can only occur with collective action and 118 pressure on industry and government to facilitate and incentivise large-scale societal shifts. Here 119 again, astronomers can play an important role in communicating the need for urgent cross-sectoral 120 systemic change.

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### 5. Embed Change in Astronomy

125 It is not just a case of making the issues more visible; climate change communication needs to be 126 accompanied by action at the individual and community level. Astronomers need to take a stance 127 and engage as advocates beyond the academy. Astronomers typically engage in a high number of 128 public engagement activities, especially when compared to scientists in other fields; a survey 129 undertaken in 2016 found it to average approximately 18 activities per year for each communicative 130 astronomer<sup>19</sup>. The majority of such public engagement events were public lectures and Open Days 131 or talks in schools (Figure 2). This provides an excellent opportunity to engage with different 132 audiences on climate change through the topic of astronomy. Astronomers for Planet Earth (A4E) is 133 a rapidly growing movement that establishes a strong connection between astronomy and climate 134 change, shares communication resources and tools and amplifies the individual voices of those 135 seeking climate justice<sup>20</sup>. 136

137 Figure 2 | Astronomers typically engage in a high number of public engagement activities. This

access to the public makes astronomers well-placed to communicate on climate change. Credit:

139 Entradas & Bauer (ref. 19).

140 141 It should be noted that a global survey of astronomers showed that, regardless of the area of the 142 world in which they worked, the most active science communicators were those who were more supported by their institutions in terms of resources<sup>19</sup>. Organisational resources and a supportive 143 culture are key to encouraging more astronomers to engage in climate change communication and 144 145 challenge misinformation and denial. Such outreach needs to be valued, incentivized and rewarded 146 by institutions. There needs to be more training, funding, and support from communications staff 147 and stricter funding requirements need to be introduced to prioritize sustainability engagement 148 work. In particular, there is potential for more two-way dialogical and participatory forms of 149 communication<sup>12</sup>. Climate change is (rightly) becoming an urgent issue in society today. Astronomers 150 are able to use astronomy as a bridge to introduce topics that hold increasing relevance and impact 151 for individuals' everyday lives. We are at a crucial point in history where the astronomy community 152 can make a hugely important contribution to engaging the public with one of the most serious 153 challenges of our time.

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