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A 3D Universe? Students' and professors' perception of multidimensionality

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Abstract. This paper discusses the importance of learning to understand the three-dimensionality of astronomical objects, in particular nebulae. After collecting data from students' and professors' discernment of 3D we finds that this is difficult for both students and professors, which highlights the importance of addressing extrapolating three-dimensionality in astronomy education.

Keywords. Spatial thinking, 3D, Astronomy Education Research

The competency to be able to extrapolate three-dimensionality (E3D) in one's mind from 1D and 2D representations has been identified as an important factor for success in learning astronomy and understanding the Universe. However, only little research has been done in investigating this competency (Eriksson *et al.* 2014, Heyer *et al.* 2013), while at the same time there is a growing interest for what and how 3D representations can contribute to learning astronomy (Cole *et al.* 2018). This paper discusses the competency to E3D in one's mind and reports on the preliminary findings from an investigation concerning students' and professors' perception of three-dimensionality when looking at 2D representations, images and simulations, of a sample of nebulae. Images are 2D and simulations can offer a sense of 3D by offering parallax motion–this is often referred to as psudo-3D. Through an on-line questionnaire university students and professors are exposed to various images and simulation of nebulae (Steffen *et al.* 2007) and asked for their perception of depth, both by numbering certain features and in explaining their reasoning. The data collection, which is still ongoing, will be analysed using a standard qualitative research methodology. The preliminary results indicate that the competency to E3D vary significantly between the participants and in particular many students struggle to see nebulae as 3D objects, which confirms earlier studies (see, for example, Eriksson *et al.* 2014, Heyer *et al.* 2013). An awareness of these findings by astronomy educators may have great importance for how teaching and learning astronomy are viewed and also how curricula development could be enhanced for optimizing astronomy education at university level. From this, and previous research (Eriksson *et al.* 2014), we recommend astronomy educators to consider, and take into account, students' difficulties in E3D regarding astronomical objects when teaching. Finally, we recommend educators helping students discern relevant 3D aspects and features of the representations used.

References

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