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Magnetospheres around High Mass Stars revealed by Polarimetry

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About 10% of the known massive stars have strong, dipolar magnetic fields. Magnetohydrodinamical simulations show that the combination of strong magnetic fields and fast rotation can lead to the formation of co-rotating magnetospheres around these objects.
A theoretical model (the Ridigly Rotating Magnetosphere model, RRM) is available for the case of very strong magnetic fields. This model was applied, with some success, to the archetype star σ Ori E. However, more recent results based on high-precision polarimetric data showed that the RRM falls short in explaining the polarization modulation, which indicates that the model cannot reproduce correctly the geometry of the σ Ori E's magnetosphere. An alternative, parametric model (dubbed the Dumbbel plus Disk model, D+D) was proposed, that allows for a good fit of the data and the successful determination of several fundamental parameters of the magnetosphere. In this work we show the results for HD35502, for which unambiguous modulation was found and a well-contrained model was developed. We also present results for HR 5907 and HR7355, the two magnetic massive stars with shortest rotation period known to date. For them the modulation detection was marginal, at best. Finally, we report an ongoing polarimetric survey made in Observatorio Pico dos Dias (OPD) for another 15 magnetic massive stars and the preliminary results for modelling 6 of them. The results are based on a novel approach to the D+D model that incorporates Bayesian statistics to fit the model to the data.
It is expected that both the increased sample and our new modelling approach will bring further light to help us understand what are the shortcomings of the RRM model, and possibly reveal the ways upon which this model can be improved.

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