

Abstract Submitted  
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**A New Effective Spin for Modelling Precessing Higher Modes in the Strong-Field**<sup>1</sup> LUCY M. THOMAS, PATRICIA SCHMIDT, GERAINT PRATTEN, Univ of Birmingham — Gravitational wave data analysis relies on accurate and efficient waveform models which incorporate physical phenomena such as precession and higher-order modes. Current semi-analytical models for precessing binary black holes are not calibrated to numerical relativity in the precessing sector, in part due to the high-dimensionality of the parameter space. One possibility lies in dimensional reduction of the precessing spin-space, previously done with  $\chi_p$ , but it has been shown that  $\chi_p$  does not accurately represent precessing higher-order modes, which are crucial for modelling a complete precessing waveform. In this talk, I will present an alternative 2D effective precession spin  $\vec{\chi}_\perp$ . I will show that it reproduces the precession dynamics and higher-order modes of strong-field precessing waveforms much more accurately than  $\chi_p$ , as well as the remnant spin. This could be a promising avenue towards meaningful calibration of semi-analytic precessing, higher-order mode waveforms to numerical relativity.

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