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Studying Frequency Relations of kHz QPOs for 4U 1636-53 and Sco X-1: Observations Confront Theories

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By fitting the frequencies of simultaneous lower and upper kilohertz Quasi-Periodic Oscillations (kHz QPOs) in two prototype neutron star QPO sources (4U~1636-536 and Sco X-1), we test the predictive power of all currently proposed QPO models. Models predict either a linear, power-law or any other relationship between the two frequencies. We found that for plausible neutron star parameters (mass and angular momentum), no model can satisfactorily reproduce the data, leading to very large chi-squared values in our fittings. Both for 4U~1636-53 and Sco X-1, this is largely due to the fact that the data significantly differ from a linear relationship. Some models perform relatively better but still have their own problems. Such a detailed comparison of data with models shall enable to identify routes for improving those models further.

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