

J52a **A Necessary Condition of Resonant Excitation of Disk Oscillations in Warped Disks**

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High-frequency quasi-periodic oscillations (QPOs) observed in black-hole low-mass X-ray binaries are suggested to be resonantly excited disk oscillations in deformed (warp or eccentric deformation) disks (Kato 2004). In this excitation process two disk oscillations resonantly couple through the deformation. Growth of oscillations by the resonant processes has been confirmed numerically (Ferreria and Ogilvie 2008; Oktariani et al. 2010). Concerning mechanism and condition of the growth, however, there seems to be no common consensus yet.

In this talk, in order to clarify the excitation mechanism, a necessary condition of the excitation is derived. The results show that in exponential growth of oscillations, the two oscillations must have the same amount of energy with the opposite signs. This suggests that the cause of exponential growth of oscillations is resonant energy exchange between negative and positive energy oscillations in the Lindblad resonant region, the disk deformation working just as a catalizer of the energy exchange between two oscillations, keeping its energy unchanged.