Tidal instability in exoplanetary systems

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Due to their observationnal method, many of the discovered exoplanets are massive gas giants called 'hot Jupiters' orbiting rapidly very close to their stars. Because of this proximity, these binary bodies (stars and planets) are strongly deformed by gravitationnal tides. Therefore, a certain number of them must be the site of an hydrodynamic instability, called the tidal instability. Starting from measured astrophysical characteristics of these systems (masses, orbit radius, eccentricity and period, spin velocity...), we show that this instability is, as expected, present in some of the stars when the ratio of the planet orbiting period to the star spinning period is not in a "forbidden range". In this case, the instability should drive strong flows in the different fluid layers of both bodies. These flows must be taken into account to model the binaries interiors and subsequent properties (synchronization, dynamos, zonal winds...). Of particular interest is the possibility of modifying the alignment of the rotation axes of stars and planets by this tidal instability.