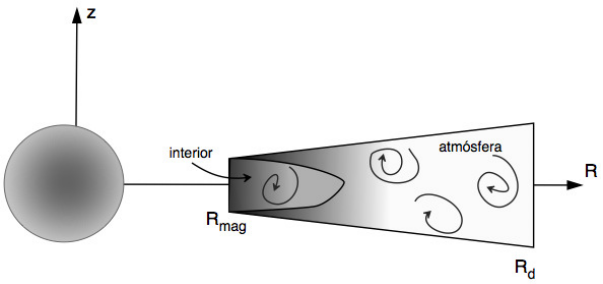

Fig. 10. A simplified distribution of a protostellar turbulent disk model to give an idea of how annular regions can form in such a disk.

mation we identify with the red color line between 0.07 and 0.15 AU.

Perhaps the origin of these regions can be found in the early formative stages of the protoplanetary disk dominated by turbulent forces that led to the formation of ring band regions (annular regions). With time, these regions evolved, and were confined into bands by the presolar material. The planets would have been formed as a result of the agglomeration of small particles into larger ones. A hydrodynamic vision has been included in the recent model of Adame (2010), who describes a turbulent protostellar disk (Figure 10) with central small masses. Here we can see certain criteria for the formation of annular regions; for example, it is possible to consider that the origin of the TBF distribution arises from a stationary wave system, according to the initial conditions, the mass of the central body being the main parameter.

5. FINAL COMMENTS AND CONCLUSIONS

We have studied the general structure of the Solar System through the Titius-Bode Law, which we have applied to the exoplanets system. It has lead to us to consider that the TBF distribution of planetary objects (equations (6–11) occurs in three great groups: Inner Solar System bodies, Major Solar System bodies and Outer Solar System bodies. For the case of Mercury ($n = 1$) we improved the determination of the semi-major axis. The order of the major objects agrees well with the integer TBF sequence, including the accumulation region ($n = 5$) represented by Ceres or the asteroid belt. In the outer Solar System, where objects with very eccentric orbits are located, we observed that the TBF integers are associated mainly to regions of accumulation of small agglomerations with values $n = 15$ or 16, and to the abundant concentrations of small objects for $n = 10$, 11 or 12.

If we consider solely those systems with central masses similar to the Sun, i.e., 55 Cnc, 61 Vir and HD69830, we can assign to certain objects values n of TBF (vulcanoids and major objects) according to equations (6–8) and Table 4. For example, 55Cnc(1) with $n = -2$, 61Vir(1) with $n = -2$, HD69830(1) with $n = -1$, and HD69830(2) with $n = 0$.

With the set of equations (equations 6–11) we can see the general orbital behavior of Solar System bodies, which appears to contain the final status of the presolar cloud processes from the stage of protoplanetary disk to planet formation. Of course, any theory would have to include other phenomena, such as migration of planets (Masset 2008), or magnetohydrodynamic phenomena that may have occurred in our Solar System. In this context, when we think about the distribution of planets in the Solar System, we are actually considering the primitive physical conditions which dominated the presolar cloud which created regions of the protoplanetary ring from which the planets were created after a process of accretion of the particles that formed these protoplanetary rings.

We have speculated that the TBF distribution arose from a stationary wave system in the presolar cloud where it induced the formation of certain annular regions, simultaneously generating turbulent accretion phenomena. On the other hand, we imagine that these conditions differ from other protoplanetary environments where the distribution and size of such rings would be subject to different chemical composition, shape, distribution and laws of accretion of the solid bodies.

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