DYNAMICS AND HABITABILITY IN VERY LOW MASS STARS THAT BELONG TO STELLAR CLUSTERS. S. Torres[1] and B. Pichardo[2], [1]Instituto de Astronomía, Universidad Nacional Autónoma de México, Apdo. postal 70-264 Ciudad Universitaria, D.F., México, storres@astroscu.unam.mx, [2]Instituto de Astronomía, Universidad Nacional Autónoma de México, barbara@astroscu.unam.mx.

Introduction: Star formation arises in dense clouds of gas and dust known as molecular clouds [1]. Thus, the most stars form in stellar clusters [2], [3], where, throughout their evolution, they suffer frequent gravitational interactions. These affect the trajectory of the star and disrupt its planetary disk [4], [5] Stellar encounters can disrupt and strip out the debris disks of its host star in dense environments such as stellar cluster. If extrasolar planet formation occurs in an analogous fashion to that believed to have occurred in our solar system, then the primary requirement is that the circumstellar disk is present and relatively stable over such time-scales. In a crowded region, any stellar encounters can perturb this disk and thus suppress its planet forming potential. One condition of the habitability in extra solar planets is to have a stable orbit for a enough period of time to allow the evolution of the life. The study and behaviour of very low mass stars it is very important in the search of exoplanets and habitable worlds, these stars burn fuel slowly and stay a much longer time on the main sequence, also are the most abundant in the Galaxy ~75 and observations of protoplanetary disks suggest that planet-building materials are common around these stars. In this work we are focus on the analysis of the structure and orbital parameters (eccentricity, perihelion, aphelion and inclinations) of the disk particles around very low mass stars after stellar encounter in dense environments such as stellar clusters and determine the conditions in which the planetary disks can survive a stellar encounter and allow the evolution and planet formation.

Numerical Implementation: We employed the stellar encounters code (SEC, [6]) to simulate the gravitational interaction between a planetary system characterized by a cold disk of test particles in a Keplerian potential and flyby star with hyperbolic orbit. In general, SEC solves the equations of motion in the non-inertial reference system of the central star, providing the required orbital parameters. The code is 3D. The sampling of orbits goes as $a \propto n^{-3/2}$, where a is the semi-major axis of the particle's orbit, and n is the number of orbits. Particles are under the influence of the stellar forces (main and flyby star), and the equations of motion are solved from the host star's non-inertial frame of reference. The code calculates the main orbital characteristics of the debris disks after a flyby, such as *eccentricity, inclinations perihelion, and aphelion*. The Bulirsh-Stoer integrator gives a maximum relative error before the flyby of 10^{-14} and 10^{-13} in the energy and angular momentum integrals, respectively.

Simulations: We perform a two set of simulation for interactions, the first one between Brown (host) and Red (flyby) dwarf stars and the second one between Red dwarf stars (host and flyby). In both cases we use the typical velocity dispersions for open and globular clusters (3km/s, and 8km/s respectively). We set the size of the disk of the host star to [0.1 to 60] AU for the case of Brown dwarf as a host star, and [0.5-70] AU for the case of the Red dwarf encounters. And we set the maximum approach of the flyby star as 300 AU due the effect begins to be considerable at this approach [6].

Discussion: In this paper we perform a numerical analysis of planetary disk orbital dynamics. To simulate different stellar environments we consider velocity dispersions typical of regions such as open and globular clusters. We found a significant change in the parameters of the disk, starting at 300 AU of maximum approach of the flyby, for both environments. Particles in the outskirts of disks acquire similar parameters that the observable ones in the Kuiper belt. This suggests that the formation of similar features of this region of the Solar System can be determine by nearby interactions with a more massive flyby star than the host. In the case of the flyby have the same mass than the host, the effect start to be considerable at interactions of 200AU for maximum approach. One important result is, even when the interaction between stars is very close (100AU) the orbital parameters of the particles in the inner part of the disk ($a<10$ AU) remains unchanged, therefore the planet formation can not be disrupt in the inner part of the disk if they have stellar encounters in the early stages of the evolution of the planetary disk even if the flyby passes to close of the system; then planets in habitable zone in very low mass stars can survive at the gravitational perturbation induced by very close interaction with a nearby star in the stellar cluster and preserving their stable orbits allowing the develop of the life. However the only possible disturbers will be the small fraction of the particles in the periphery of the disk that acquired similar parameters than short and long period comets.

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