WHICH ARE THE DWARFS IN THE SOLAR SYSTEM? G. Tancredi[1,2] , S. Favre [1,2] [1] Depto. Astronomía, Fac. Ciencias, Montevideo, Uruguay, [2] Observatorio Astronómico Los Molinos, MEC, Uruguay

Introduction: The International Astronomical Union recently adopted in its XXVI General Assembly a definition of planets in the Solar System. Changing 76 years of tradition, our Solar System has 8 planets and an increasing number of a new category of bodies named "dwarf planets". According to the resolution: *"A "dwarf planet" is a celestial body that has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape and has not cleared the neighbourhood around its orbit"*. In a footnote, the resolution says: *"An IAU process will be established to assign borderline objects into either "dwarf planet" and other categories."*

In order to contribute to the establishment of this classification procedure, we analyze the problem of the minimum mass required to become a "dwarf planet", either from the theoretical and the observational perspective. We find that icy objects with diameters D >450 km and rocky objects with D >800km can be considered as "dwarf planets".

Nevertheless, the precise estimate of the size is a difficult task for most of the recently discovered objects in the transneptunian region. Therefore, we propose a classification criteria based on the available information on the shape and size of TNOs, principally the direct or indirect estimates of the diameter and the estimate of the shapes from the lightcurve.

We present the criteria as a step by step decision tree:

1) The estimated diameter of the body should be D >450 km for icy objects and D >800km for rocky ones. These limits are not precisely determined and they depend on factors like the composition of the material and the ambient temperature.

2) If there is a direct measurement of the relative roughness with values < 1% and the shape correspond to a figure of equilibrium, the candidate is accepted (*Case I*).

3) If not, we analyze the observed lightcurve amplitude (Δm). [(1)]

4) If $\Delta m < 0.15$ *mag*, the candidate is accepted as a small departure from a sphere or MacLaurin spheroid with small albedo spots (*Case II*).

5) If $\Delta m \geq 0.15$ *mag*, the lightcurve (the intensity square) is fitted to a Fourier series of order two and the ratio (β) between the quadratic sums of the coefficients of order 1 and 2 is computed.

6) If β <0.25, the lightcurve can be fitted to a triaxial ellipsoid. We then analyze if this ellipsoid corresponds to the Jacobi family. We compute the range of possible densities as a function of the assumed aspect angle of the observed lightcurve.

7) If there are solutions with $\rho \geq 1$ gr.cm^{-3}, the candidate is accepted as a Jacobi ellipsoid (*Case III*).

8) If all the solutions correspond to ρ <1 gr.cm^{-3}, the candidate is not accepted. The size might be overestimated due to an assumption of a low albedo (p_v>>0.1) (*Case IV*).

9) If β >0.25, the candidate is not accepted, the lightcurve departs from an ellipsoidal figure possibly due to important contributions of albedo spots or there is an overestimation of the size due to an assumption of a low albedo (p_v>>0.1) (*Case V*).

A list of 39 preliminary candidates of icy "dwarf planets" was made based on the estimated diameter. From this list we compiled the available observational data of these objects published in more than 30 articles. According to our classification scheme there is only one rocky "dwarf planet" and 12 icy "dwarf planets" among the already discovered objects (see Table I).

We present an update from a previous version of this work [1] with the present list of "dwaf planets" based in the most recent available data.

List of "Dwarf Planets"	
Case I – Direct measurement of the shape	(1)-Ceres, (134340)-Pluto, (136199)-Eris
Case II – Sphere or MacLaurin ellipsoid with small albedo spots	(15874), (26375) ?, (28978)-Ixion, (38628)-Huya, (42301) ?, (47171) ?, (50000)-Quaoar, (55565), (55636), (90377)-Sedna, (90482)-Orcus, (90568) ?, 2001QF298 ?, 2003AZ84 ?
Case III – Jacobi ellipsoid with reasonable density	(20000)-Varuna, (136108)

Table I - List of "Dwarf Planets"

References: [1] Tancredi and Favre, Icarus, 2008, DOI: 10.1016/j.icarus.2007.12.020

[1] Since we do not have any information of the viewing geometry, we will assume that the observed amplitude corresponds to the maximum possible amplitude for the object.