ON A PROBLEM OF EXISTENCE OF MARTIAN COMETARY FAMILY. N. I. Perov[1] [1]Astronomical Observatory, State Pedagogical University, Respublikanskaya, 108, Yaroslavl, 150000, Russia. E-mail perov@yspu.yar.ru.

Introduction: Of special interest for exploration of Phobos and Deimos are the following: the development of theoretical methods for the space-time location of undiscovered hazardous comets (and radiants of unidentified meteor shower), because discovery of comets is still believed to be an accidental and, moreover, unpredictable process; the prediction of the appearance in the vicinity of Mars of uncatalogued (undiscovered) minor bodies. For the Earth these problems are very much paid attention in comparison with the other planets [1], [2], [3], [4]. These problems are connected with problem of origin of comets. We put out three models of the origin of comets. 1) Comets with periods P>200 yr come from a spherically symmetric cloud [5]. 2) These bodies are dynamically linked to the Kuiper belt [6]. 3) The comets come from interstellar medium [7]. Below a model of origin of (any) family of comets of Mars is considered.

A Model of Origin of Any Martian Comet Family: In accordance with [7] consider the three – dimensional model of the interaction of a parabolic comet with a planet of mass M_P. The comet, moving at a velocity $\boldsymbol{V}_c$, approaches, at the perihelion of its heliocentric orbit, a planet moving in a circular orbit with velocity $\boldsymbol{V}_P$. The orbital planes of the comet and planet are tilted at an angle i_0 to each other. We reduce the interaction between the comet and the planet to the instantaneous turn of the vector of relative velocity $|\boldsymbol{V}_{cP}|= |\boldsymbol{V}_{cP}'|$ of the comet. Here, $|\boldsymbol{V}_{cP}|$ is the vector of the initial velocity of the comet relative to the planet and $|\boldsymbol{V}_{cP}'|$ is the vector of the final velocity of the comet relative to the planet. The angle θ by which the velocity of the comet turns (in the sphere of influence of the planet) is maximal if the comet approaches the planet to a minimum distance without disrupting. We assume that this distance is equal to the radius R_P of the planet. We introduce so-called impact parameter ρ of the comet [8]. The impact parameter is equal to the length of a perpendicular dropped from the center of the planet to the direction $\boldsymbol{V}_\infty$ the distance at which the comet would have passed near the planet lacked gravitational field [8]. $\boldsymbol{V}_\infty$ is the velocity of the comet at the boundary of the sphere of action of the planet. We now set $r_P=r_c$ for heliocentric motion to derive analytical formulae for the turn angle θ of the vector of the velocity of the comet in the sphere of influence of the planet, the semimajor axis a_f, the eccentricity e_f and the final inclination i_f between the orbital planes of the planet and comet. We designate

$$\nu' = ((M_S / M_P)(R_P / r_P)(3 - 2^{3/2}\cos i_0) + 1)^{-2} \quad (1)$$

(M_S is mass of the Sun. It is evident $0<\nu'<1$.)

We then obtain following formulae for the unknown quantities:

$$\cos\theta = 1 - 2\nu', \quad (2)$$

$$a_f = r_P / (4\nu'(2^{1/2}\cos i_0 - 1), \quad (3)$$

$$e_f^2 = 1 - 8\nu'(2^{1/2}\cos i_0 - 1)\times$$
$$((1 - 2^{1/2}\nu'(2^{1/2}\cos i_0))^2 + 2\nu'^2 \sin^2 i_0), \quad (4)$$

$$\tan i_f = \pm \sin i_0((1 - 2\nu')/(\cos i_0 - 2^{1/2}\nu'(2^{1/2}\cos i_0 - 1)) \quad (5)$$

For any hypothetical cometary families of Mars we now give the computed parameters (for encounters between comets and Mars).

Table 1. Capture of comets by Mars at perihelia of the initial parabolic comet orbits with subsequent ejection

i_0, deg	ν'	a_f, AU	e_f	i_f, deg
0	0.0124	73.921	0.9795	0
180	0.0135×10^{-4}	-11638.9	1.000131	180

Moreover, ρ_{min}/R_P=1.004 (i_0=180 deg); ρ_{max}/R_P =1.119 (i_0=0 deg) and minimal heliocentrical periods of comets of (any) family of Mars are greater then 631.70 yr for the considered model. (So, these comets are difficult to discover).

Conclusion: The model of the transition of comets from parabolic orbits into short and long period orbits makes it possible to do the following: (a) chose more definitely the initial conditions for the process of comet migration [9]; (b) explain the deficit of observed comets with perihelion distances $r\Pi$ <2.5 AU; (c) may be used for solving of the problem of cometary hazard in the space near the Mars, Phobos and Deimos.

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