Homework 3

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PHY121.3 Vertiefung zu Physik

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Exercise 1. *Potential and field lines.* Draw the equipotential lines ,the field lines and L_1 for the system depicted in Figure 1 (M_1=10M_2).

The dotted lines can be used as a guide for drawing the field and equipotential lines
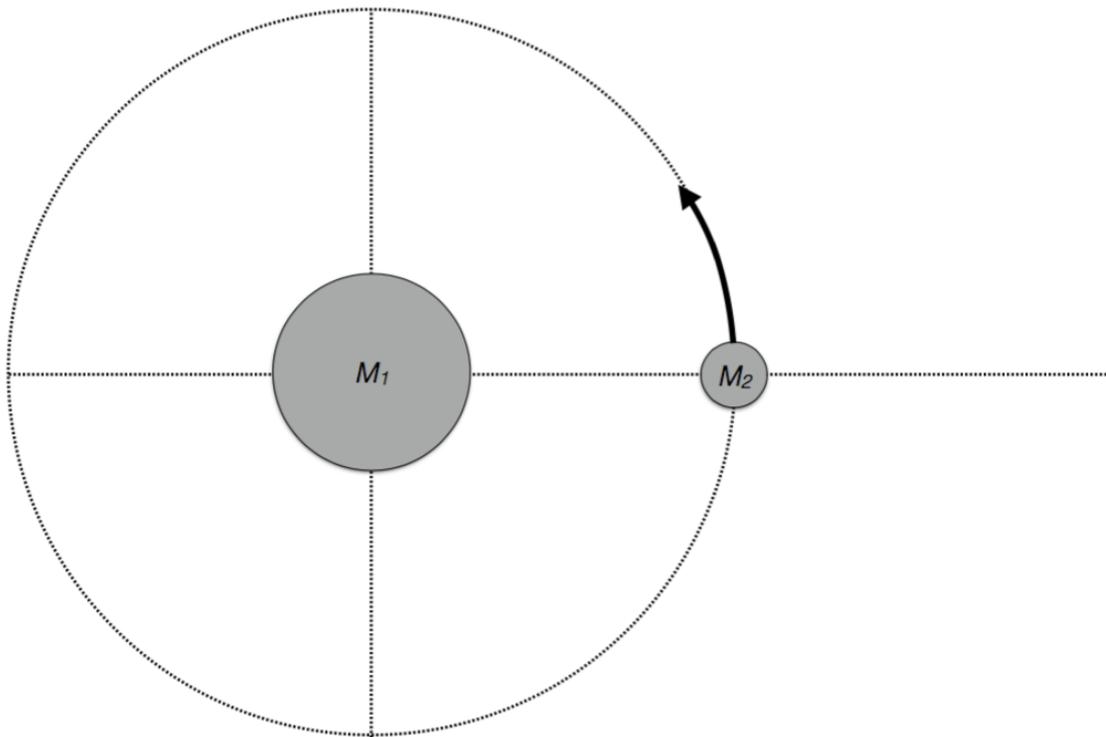

Figure 1: Two body system, M_2 gravitate around the central massive body M_1
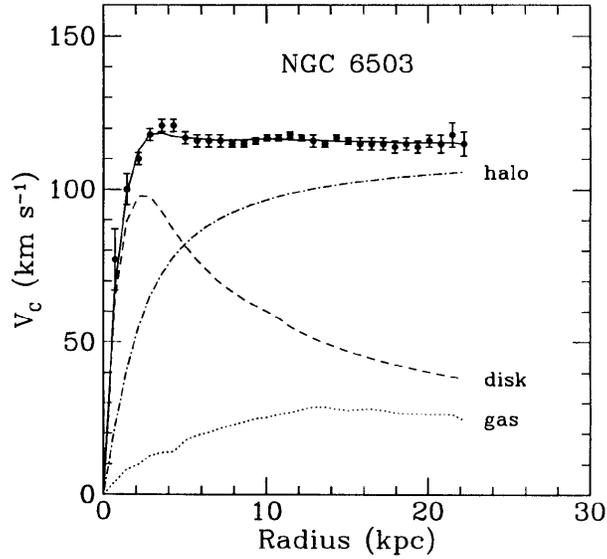
Figure 2: Velocity curve for the "Lost-in-Space galaxy" N6503. source: arXiv:0812.4005 [astro-ph].

Exercise 2. *Galactic density mass profile* . The first hint of the existence of dark matter was found looking at the rotational velocity of galaxies. Assuming galaxies are cylinders with a mass density profile that depends only on radius:

$$\rho(h, r, \theta) = \rho(r) \tag{1}$$

and hence the mass contained in a concentric cylinder with radius r is $M(r) = \int_0^r \rho(R)dR$. Assuming that the rotational velocity of the galaxy is a known function $v(R)$.

a) Calculate the function $M(r)$;

b) In the approximation $v(r) = v_0$, find density mass profile $\rho(r)$.