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Is dark matter really necessary

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The notion of dark matter was invented in the thirties by Fritz Zwicky as a necessary explanation of the dynamical equilibrium of the galaxies and clusters of galaxies. However, that equilibrium is possible, without dark matter, if it is not perfect and if the galaxies keep almost all their stars but loose continuously into outer space a small part of their clouds of gas. A similar phenomenon exists in the solar system that loses continuously the solar wind (several millions of tons per second) into interstellar space. For the clusters of galaxies, the gravitation is not the main dynamical phenomenon, it is the expansion of the Universe. Even without dark matter, the dispersion of clusters is slower than the expansion and so the clusters keep their individuality and their existence.

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