TEMNA SNOV: RAZISKAVE NEVIDNEGA V DVEH KOZMOLOŠKIH SUPERPOSPEŠEVALNIKIH „IZSTRELEK“ 1E0657–56 IN MACSJ0025.4–1222

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Jata galaksij 1E0657–56 je ena izmed najbolj raziskanih jat galaksij. Na prvi pogled je bila to čisto navadna jata galaksij, sestavljena iz galaksij, vročega plina in, kot so astronomi ugotovili za jato Coma že leta 1933 [1], tudi iz temne snovi. Nova opazovanja z vesoljskima teleskopoma Chandra in Hubble pa so odkrila, da vidimo dve ogromni jati galaksij, ki sta trčili pred približno 10^8 leti. Gost oblak plina ima po trku obliko naboja, po kateri je jata dobila ime Izstrelek (v angleščini „Bullet Cluster“). Prav s to jato smo lahko astronomi prvič tudi izmerili lastnosti temne snovi. Trk jat je povzročil, da se je plin, ki ima velik sipalni presek (se obnaša kot plazma) upočasnil. Galaksije, ki zavzemajo majhen volumen, pa med sabo ne interagirajo, zato skoraj nemoteno preživijo takšen trk. Temna snov, kot bomo pokazali kasneje, se prav tako ni upočasnila. Ker je difuzno porazdeljena, smo ugotovili, da reagira drugače kot navadna snov in ima majhen ali ničelni sipalni presek za sipanje na temni snovi in tudi na navadni snovi. To pa ni edina jata galaksij, s katero raziskujemo lastnosti temne snovi. Jata MACS J0025.4–1222 je prav tako posledica trka dveh jat galaksij, s katero smo potrdili rezultate o obstoju in majhnem sipalnem preseku temne snovi.

DARK MATTER: REVEALING THE INVISIBLE WITH 2 COSMIC SUPERCOLLIDERS “THE BULLET CLUSTER” 1E0657–56 AND MACSJ0025–1222

The cluster of galaxies 1E0657–56 (The Bullet Cluster) has been the subject of intense research in the last few years. On a first glance this is an ordinary cluster of galaxies, whose main components are galaxies, hot gas, and as the astronomers first discovered in 1933 from observations of the Coma cluster, also dark matter. New observations with Hubble Space Telescope (HST) and Chandra Space Telescope have revealed, that 1E0657–56 consists of two clusters of galaxies that collided approximately 10^8 years ago. Dense and hot gas acquired a shape of a bullet after the merger, earning it the nickname “The Bullet Cluster”. The collision of both clusters has caused the hot gas, which behaves like a plasma, to interact and slow down. Galaxies, on the other hand, span a relatively small volume and are effectively collisionless, hence they survived the collision almost undisturbed. We will show, that dark matter, just like galaxies did not slow down either. However, since the latter is smoothly distributed, we discovered that it has a small or zero dark matter-dark matter and dark matter-baryons scattering cross-section. In addition, recently we have discovered a new Bullet-like cluster, MACSJ0025–1222. This cluster exhibits many similar properties to the Bullet Cluster, and we have confirmed the result of the existence and small scattering cross-section of dark matter.