Dark Energy and Dark Matter – discovering their mysterious nature and discussing consequences

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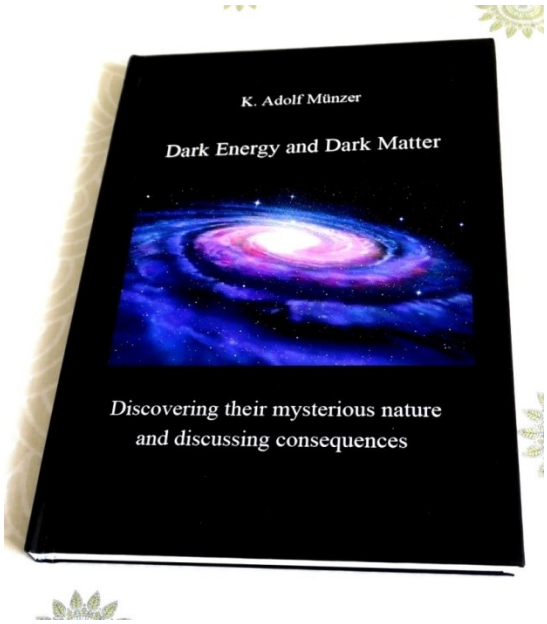
New results for the physics and for the mathematical formulation of Dark Energy and Dark Matter



Based on the constant rotational speed of spiral galaxies and on the accelerated expansion rate of celestial bodies, the following statements were drawn and mathematically drafted:

According to the investigations, dark matter corresponds to a cloud or a halo of accumulated cosmological energy around gravitational centers such as black holes.

According to the investigations, dark energy corresponds to an omnipresent, homogeneous cosmological energy that is infinitely spread throughout the universe, from which matter can and does arise at any time and anywhere, without the need of a Big Bang.

For the mathematical description, the well-known Friedmann solutions of the Einstein equation including the cosmological constant lambda for dark energy was expanded with an additional mathematical term for dark matter and its accumulation constant sigma and was successfully applied, e.g. to calculate the peculiar velocity of the Andromeda galaxy.

Dark energy, or now called cosmological energy, is actually the primary physical quantity in the universe. Dark matter, or newly called cosmological energy accumulated around gravitational centers, is a secondary and derived physical quantity, being an accumulation of

cosmological energy. This classification is also expressed in the succession of the terms in the book title.

According to the new theory, the universe actually consists purely of approximately 95.5% cosmological energy, of which approximately 30% is concentrated around gravitational centers such as black holes, and an additional approximately 4.5% baryonic matter, which has been arosen out of cosmological energy. The ratio was determined to be approximately 65.5% widespread cosmological energy, or dark energy, approximately 30% accumulated cosmological energy, or dark matter, and approximately 4.5% baryonic matter.

The derivation of both energy forms and their mathematical descriptions, as well as the physical explanations, are explained in the presented book. The book is available as a hardcover or e-book from the publisher "tredition GmbH," Heinz-Beusen-Stieg 5, 22926 Ahrensburg, or from bookstores, ISBN 978-3-384-59774-8 or ISBN 978-3-384-59775-5.

Summary of the most important mathematical relationships in the book:

Equations of existing theory:

Einstein-equation: $G_{\mu\nu} = R_{\mu\nu} - ½ * g_{\mu\nu} * R = \kappa * T_{\mu\nu}$

Einstein's equation extended with the cosmological constant Λ to describe the expansion of the universe: $G_{\mu\nu} - \Lambda * g_{\mu\nu} = \kappa * T_{\mu\nu}$

Friedmann equations as solutions for a homogeneous and isotropic universe:

Expansion rate equation: $H^2 = [(dR/dt) / R]^2 = 8/3 * \pi * G * \rho - k * c^2 / R^2 + \Lambda * c^2 /3$

Acceleration equation: $[d^2R/dt^2 / R] = - 4 * \pi * G / 3 * (\rho + 3 * p / c^2) + \Lambda * c^2 / 3$

Extension of the existing equations in this book:

In this work, a further extension of the Einstein equation, already extended for the expansion rate, regarding the cohesion of galaxies was found:

$$G_{\mu\nu} = R_{\mu\nu} - ½ * g_{\mu\nu} * R = \kappa * T_{\mu\nu}(\rho_b) + \Lambda^* * T_{\mu\nu}(\rho_C) + \Sigma * g_{\mu\nu}$$

baryonic component: $\kappa * T_{\mu\nu}(\rho_b)$

expansion behaviour: $\Lambda^* * T_{\mu\nu}(\rho_C)$

cohesion of galaxies: $\Sigma * g_{\mu\nu}$

Solutions for a homogeneous and isotropic universe analogous to the Friedmann solutions are:

Acceleration equation:

$$[d^2R(t)/dt^2] = - 4/3 * \pi * G * \rho_b * R(t) + \Lambda^* *4/3 * \pi * G *\rho_C* R(t) + \Sigma * G * \rho_C / R(t)$$

Expansion rate equation:

$$dR(t)/dt = A + 2/3 * \pi * G * [-\rho_b + \Lambda^* *\rho_C] * R^2(t) + \Sigma * G * \rho_C * \ln R(t)$$

The expansion rate equation describes the velocity dR(t)/dt of celestial bodies and can be parameterized as a function of the distance R(t): $dR/dt = A + B * R^2(t) + C * \ln R(t)$

or as a function of the expansion rate a(t): $da/dt = A + B * a^2(t) + C * \ln a(t)$

Using a transformation according to Hubble's law $c * z' = H_0(z') * R(t)$, the parameterized equation for the expansion rate can be transformed from the time-dependent spatial representation $dR/dt = A + B * R^2(t) + C * \ln R(t)$ into a representation consisting of the cosmological redshift z, resulting in: $H(z) = A + B * z^2 + C * \ln z$.

This theoretical dependence on the cosmological redshift calculates exactly the metrologically determined Hubble parameters H(z) and thus provides evidence for the agreement of the new theory with the measured data, i.e. for the agreement between theory and experiment.

Since the equations for the acceleration and for the expansion rate are generally valid throughout the cosmos, they were applied to calculate and to explain both the constant rotation speed of spiral galaxies as well as the peculiar speed of the Andromeda Galaxy.