Neutrinos and dark matter in astrophysics

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There is strong evidence on very different astrophysical and cosmological scales that normal baryonic matter contribute only to one part out of six to the matter of our universe. The remaining part is called dark matter. Struture formation in the universe requires the majority of the dark matter to be cold or warm at least, i.e. non-relativistic during structure formation. Neutrinos are the only known, but subdominant part, all the rest of the dark matter has to be exotic, i.e. particles beyond the Standard Model of particle physics. Still neutrinos with there tiny but non-zero masses and mixings play a vital role in astrophysical processes, e.g. in supernova explosions. The possible Majorana character of neutrinos might also be connected to the observed baryon asymmetry of the universe.

After an introduction into the evidences for dark matter and the properties of neutrinos the search for the neutrino mass as well as the search for neutrinoless double beta decay (and the Majorana character of neutrinos) will be presented. The search for various candidates of dark matter will be described in the second part. These searches will be explained in more detail at the examples of the current experiments KATRIN, GERDA and XENON1T.