Propositions accompanying the thesis

Hunting Dark Matter with X-Rays

1. There exists a spectral feature at 3.5 keV in X-ray data of galaxies and galaxy clusters that potentially originates from the decay of Dark Matter. *(Chapter 2)*

2. Because it is very challenging to rule out instrumental or astrophysical interpretations of the 3.5 keV line for each individual object, it is necessary to compare many different objects in order to judge whether the Dark Matter decay interpretation is valid or not. *(Chapters 2, 3 & 4)*

3. Although the megasecond of clean exposure time of the Draco dwarf galaxy by the XMM-Newton telescope provided only an inconclusive result, doubling this exposure could provide a very strong argument either for or against the Dark Matter interpretation of the 3.5 keV signal. *(Chapter 3)*

4. The radial distribution of the 3.5 keV signal can become a very important observable in order to determine its origin, as and if deep exposures at all radii become available. *(Chapter 4)*

5. It is possible to determine directly whether a Dark Matter decay signal above a certain luminosity exists in a wide field data set without the need for modeling the X-ray spectrum or subtracting backgrounds by employing a correlation-type analysis with respect to a tracer of the Dark Matter distribution. *(Chapter 5)*

6. The results of the *Hitomi* Collaboration, regarding the limited available *Hitomi* data around 3.5 keV of the Perseus cluster, do not contradict the Dark Matter interpretation of previous work, contrary to what the authors claim.
Hitomi Collaboration, ArXiv 1607.07420, submitted to Astrophys. J. L.

7. Although it is claimed that the laboratory measurement of Shah et al. 2016, of a 3.47 keV emission feature from charge-exchange between S XVI and neutral hydrogen "compellingly supports" this interpretation of the 3.5 keV signal, the absence of predictions of the 3.5 keV flux and spatial distribution for the charge-exchange scenario preclude the making of quantitative statements regarding the merits of this interpretation.
Shah et al.: ArXiv 1608.04751, to appear in Astrophys. J.

8. Considering that MOND has phenomenological merit in simple astrophysical systems, the fact that the Entropic Gravity theory of Verlinde reduces to the MOND description for spherical and static objects, suggests the possibility that particle Dark Matter may be challenged if serious effort will be dedicated to describing the primordial density fluctuations with alternative gravity theories. *Verlinde: J. High Energy Phys., 29, 2011.*

9. The results of Bernal et al 2016 imply that morphology can not be used as a diagnostic for extragalactic Dark Matter decay or annihilation searches, (unless high resolution lensing maps of the individual clusters become available), although the systematic uncertainties induced by asphericity of the DM halo on the predicted 3.5 keV flux per observation could be larger than expected and should be investigated. *Bernal et al.: ArXiv 1606.00433.*

10. Universities should not be run like businesses although scientific productivity could benefit greatly from workflow solutions developed for businesses.

11. The trust the general public places in science and in experts in general is harmed by the contradictory way in which science is portrayed as a simple series of facts in public media and schools on the one hand, and how the process of science inherently deals with the unknown and the uncertain on the other.

12. The critique of an idea is not a judgment of the person(s) holding that idea.

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