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Vast and Fast Data in the era of the large astrophysics and particle physics experiments

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PROPOSITIONS

accompanying the dissertation

VAST AND FAST DATA IN THE ERA OF LARGE ASTROPHYSICS AND PARTICLE PHYSICS EXPERIMENTS

1. Research has entered a data-centric era driven by the development of sophisticated research experiments, necessitating novel computational tools able to transform complex data into coherent information-based contents (This thesis).
2. Efficiently extracting and analyzing the morphological properties of structures in gigantic data sets is now achievable with DISCCOFAN, a novel massively-parallel computational tool building upon component tree techniques (Chapters 2 and 3).
3. Valuable insights into the escape fraction of ionizing photons of high-redshift galaxies can be obtained by constraining their interstellar medium porosity and dust attenuation (Chapter 4).
4. Optimal strategies to interpret upcoming 21-cm observations with the Square Kilometer Array should combine tomographic and power spectra analyses to capture all the astrophysical information and mitigate the biases due to imperfect foreground removal (Chapter 5).
5. Local point-by-point approaches provide simple yet efficient techniques to reconstruct particle trajectories on-the-fly during experiments involving particle collisions at very high interaction rates (Chapter 6).
6. Universities should terminate the Ph.D. scholarship experiment.
7. The “in-built” propensity to cycle among the Dutch makes them particularly well set-up to compete against hippopotamuses during a triathlon.
8. In realizing most of its hunting potential, an eagle might be better trained by owls than by falcons.
9. On the one hand, the explosive nature of scientific progress indicates we might overcome the critical climatic challenges of the next decades. On the other hand, the social inertia inherent to our modern societies suggests these efforts might still result in a vast collective failure.
10. Navigating in Science means constantly walking a fine line between blind faith and curiosity; between expertise and creativity; between bias and openness; between experience and epiphany; between ambition and passion; and between arrogance and conviction – in short, between an old today and a new tomorrow (Heinrich Rohrer).