Supercomputing Center) presented his Parallel In-Memory Database, where the active storage is used to implement a key-value store.

Active storage concepts could also be utilized by climate science applications, as pointed out by Nathanael Hübbe (University of Hamburg), to implement lossless compression and thus reduce the growing amount of data written to and read from large capacity, external storage systems.

Managing increasing data volumes is also a challenge for research in astronomy and radio astronomy. David Champion (MPI for Radio-Astronomy) explained how to search for pulsars in petabytes of data generated by planned surveys of the universe with high time resolution. Astronomy is traditionally data driven, as pointed out by Alex Szalay (Johns Hopkins University), who had been one of the architects of the archive of the Sloan Digital Sky Survey project. By making data accessible and by enabling any scientist to process this data, such archives turn into unique research instruments. Active storage concepts can help to bridge the gap between large capacity data services and HPC.

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Figure 3. A galaxy-quasar combination found using the Sloan Digital Sky Survey (Credit: NASA, ESA/Hubble and F. Courbin (Ecole Polytechnique Federale de Lausanne, Switzerland)).

References

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International Workshop on Cooperative Quantum Dynamics and Its Control (CQDC2012)

The "International Workshop on Cooperative Quantum Dynamics and Its Control (CQDC2012)" took place from 29 to 31 October 2012 at the rotunda of the Jülich Supercomputing Centre. The goal of the workshop was to discuss the possibility of essentially new quantum phenomena, and to discuss the observations and/or operations that would be required for their realization, detection, and understanding.

About 40 researchers from Germany, France, Switzerland, the Netherlands, Canada, the United States and Japan participated in the workshop. Recent developments in quantum annealing, open quantum systems, quantum computer hardware, quantum dynamics of spin systems, equilibration and thermalization of quantum systems, decoherence, entanglement and related topics were highlighted in talks and posters.

Quantum dynamics and novel quantum states in systems of many particles or spins, many of which have been beyond the reach of experimental realization, are now getting more and more realistic due to recent advancements in experimental techniques, such as the synthesis of molecular magnets, nano-engineering of quantum dots, time-resolved measurements with ultra-short pulses, and optical lattices of cold atoms.

In particular, many attempts have been made for characterizing the wave function from the viewpoint of entanglement, which is often accomplished by the aid of supercomputers through the method of direct numerical solution of the evolution equation and/or through quantum Monte Carlo methods. In addition, new numerical methods, such as the tensor-network variational approximation, are making many previously hard problems now tractable.

The exploitation of quantum effects, requiring coherent control of dissipative dynamics and entanglement control, is expected to have profound implications for future emerging information technologies. Managing and designing complex quantum systems with specified behaviour for quantum information processing requires a deep understanding of the cooperative behaviour of their components. Unraveling this behaviour necessitates an intensive collaboration between theoreticians and experimenters. The workshop successfully presented an overview of the current research on various topics very closely and less closely related to quantum information processing.

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