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ICTS SPECIAL COLLOQUIUM

Monitored Quantum Hitting Times on NISQ Platforms

We introduce a time-energy uncertainty relation within the context of monitored quantum dynamics [1] . Previous studies have established that the mean recurrence time, which represents the time taken to return to the initial state, is quantized as an integer multiple of the sampling time, displaying point-wise discontinuous transitions at resonances. Our findings demonstrate that the natural utilization of the restart mechanism in laboratory experiments [2], driven by finite data collection time spans, leads to a broadening effect on the transitions of the mean recurrence time. Our proposed uncertainty relation captures the underlying essence of these phenomena, by connecting the broadening of the mean hitting time near resonances, to the intrinsic energies of the quantum system and to the fluctuations of recurrence time. Our uncertainty relation has also been validated through remote experiments conducted on an International Business Machines Corporation (IBM) quantum computer. We then discuss fractional quantization of the recurrence time for interacting spin systems using sub-space measurements [3].

References

[1] R. Yin, Q. Wang, S. Tornow, and E. Barkai, Restart uncertainty relation for monitored quantum dynamics Proceedings of the National Academy of Sciences 122 (1) e2402912121, (2025).

[2] R. Yin, E. Barkai Restart expedites quantum walk hitting times Phys. Rev. Lett. 130, 050802 (2023).

[3] Q. Liu, S. Tornow, D. Kessler, and E. Barkai Properties of Fractionally Quantized Recurrence Times for Interacting Spin Models arXiv:2401.09810 [condmat.stat-mech]

Eli Barkai

Bar Ilan University, Israel

Prof. Barkai, a physicist with a rich academic background from Tel-Aviv University,where he completed his B.Sc, M.Sc, and Ph.D. in Physics. Prof. Barkai's postdoctoral journey began at the Massachusetts Institute of Technology in 1998, leading to a faculty position at the University of Notre Dame in 2002, and eventually bringing him back to Israel in 2004 to join Bar-Ilan University's Physics Department.
His research focuses on statistical physics, especially in understanding complex phenomena like diffusion and relaxation in disordered systems, and the intricacies of weak chaos and ergodic theory. Prof. Barkai has applied his work to areas such as quantum dot behavior, single-molecule transport in cells, and laser cooling. Recently, he has delved into theoretical aspects of quantum mechanics mingled with repeated measurements, exploring its implications on intermediate noisy quantum computers.

27 January 2026

3:30 PM

Madhava Lecture Hall

Zoom link: https://shorturl.at/IQ4XH

Meeting ID: 974 2731 9810

Passcode: 218183