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Multipartite Entanglement And Firewalls SHENGQIAO LUO, HENRY STOLTENBERG, ANDREAS ALBRECHT, Univ of California - Davis — Black holes offer an exciting area to explore the nature of quantum gravity. The classic work on Hawking radiation indicates that black holes should decay via quantum effects, but our ideas about how this might work at a technical level are incomplete. Recently Almheiri-Marolf-Polchinski-Sully AMPS have noted an apparent paradox in reconciling fundamental properties of quantum mechanics with standard beliefs about black holes. One way to resolve the paradox is to postulate the existence of a "firewall" inside the black hole horizon which prevents objects from falling smoothly toward the singularity. A fundamental limitation on the behavior of quantum entanglement known as "monogamy" plays a key role in the AMPS argument. Our goal is to study and apply many-body entanglement theory to consider the entanglement among different parts of Hawking radiation and black holes. We identified an example which could change the AMPS accounting of quantum entanglement and perhaps eliminating the need for a firewall. Looking at different many body entanglement measures and their monogamy properties can tell us subtle ways in which different subsystems can share their entanglement. Specific measures we consider include negativity, concurrence, and mutual information. Taking insights from these different measures, we constructed toy models for black hole decay which have different entanglement behaviors than those assumed by AMPS. We hope to use our effective toy model to demonstrate interesting new ways of thinking about black holes.

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