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Electron holes appear to trigger cancer-implicated mutations.[1]
JOHN MILLER, MARTHA VILLAGRAN, University of Houston, Dept. of Physics Texas Ctr. for Superconductivity — Malignant tumors are caused by mutations, which also affect their subsequent growth and evolution. We use a novel approach, computational DNA hole spectroscopy [M.Y. Suarez-Villagran & J.H. Miller, *Sci. Rep.* **5**, 13571 (2015)], to compute spectra of enhanced hole probability based on actual sequence data. A hole is a mobile site of positive charge created when an electron is removed, for example by radiation or contact with a mutagenic agent. Peaks in the hole spectrum depict sites where holes tend to localize and potentially trigger a base pair mismatch during replication. Our studies of reveal a correlation between hole spectrum peaks and spikes in human mutation frequencies. Importantly, we also find that hole peak positions that do *not* coincide with large variant frequencies often coincide with cancer-implicated mutations and/or (for coding DNA) encoded conserved amino acids. This enables combining hole spectra with variant data to identify critical base pairs and potential cancer 'driver' mutations. Such integration of DNA hole and variance spectra could also prove invaluable for pinpointing critical regions, and sites of driver mutations, in the vast non-protein-coding genome.

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