1116-81-1218 **Jake Farinholt***, Naval Surface Warfare Ctr, Dahlgren Division, 18444 Frontage Road, Suite 327, Building 1470, Dahlgren, VA 22448-5161. *A Geometric Characterization of Quantum Weak Values.*

In 1988, Aharonov *et al.* discovered "weak measurements" in quantum mechanics. Curiously, these measurements can be constructed such that their measurement results, or "weak values," lie far outside the eigenspectrum of the observable being measured; in fact, they can take on any complex value. More explicitly, let $|\varphi\rangle$ denote the state of the quantum system prior to weak measurement (the "pre-selected state"), let M denote the Hermitian observable being weakly measured, and let $|\psi\rangle$ denote the state of the quantum system after a strong measurement (the "post-selected state"). The corresponding weak value is then given by the following function on the vector space of Hermitian operators:

$$A_{|\varphi\rangle,|\psi\rangle}(M) = \frac{\langle\psi|M|\varphi\rangle}{\langle\psi|\varphi\rangle}.$$

We are driven by the following question. For a given complex number α and some arbitrary weak value function $A = A_{|\varphi\rangle,|\psi\rangle}$, what is the pre-image of α under A? It turns out that the solution is fundamentally geometric, and in turn reveals hitherto unseen underlying geometric structure in weak values. In the case of qubits, we provide a complete geometric characterization. (Received September 17, 2015)