**Abstract**

A Rydberg atom mixer determines a phase of modulated carrier radiation and includes: a reference radiofrequency source for reference radiofrequency radiation; a modulated carrier source for modulated carrier radiation; a vapor cell to contain gas atoms that receive reference radiofrequency radiation and modulated carrier radiation, such that the gas atoms produce modulated light modulated; and a transmission detector to detect the modulated light from the vapor cell and produces a transmission signal from the transmission detector for determination of a phase of the modulated carrier radiation, wherein the Rydberg atom mixer mixes the reference radiofrequency radiation and the modulated carrier radiation by the gas atoms to produce the intermediate frequency IF that corresponds directly to the phase of the modulated carrier radiation.

**Claims**

16 Claims, 31 Drawing Sheets