derson of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

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Pattern-Recognition Algorithm for Locking Laser Frequency

A computer program serves as part of a feedback control system that locks the frequency of a laser to one of the spectral peaks of cesium atoms in an optical-absorption cell. The system analyzes a saturation absorption spectrum to find a target peak and commands a laser-frequency-control circuit to minimize an error signal representing the difference between the laser frequency and the target peak. The program implements an algorithm consisting of the following steps:

- Acquire a saturation absorption signal while scanning the laser through the frequency range of interest.
- Condition the signal by use of convolution filtering.
- Detect peaks.
- Match the peaks in the signal to a pattern of known spectral peaks by use of a pattern-recognition algorithm.
- Add missing peaks.
- Tune the laser to the desired peak and thereafter lock onto this peak.

Finding and locking onto the desired peak is a challenging problem, given that the saturation absorption signal includes noise and other spurious signal components; the problem is further complicated by nonlinearity and shifting of the voltage-to-frequency correspondence. The pattern-recognition algorithm, which is based on Hausdorff distance, is what enables the program to meet these challenges.

This program was written by Vahag Karayan, William Klipstein, Daphna Enzer, Philip Yates, Robert Thompson, and George Wells of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

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