[26, 27]. This resonance corresponds to the symmetry-allowed crossing encircled in Fig. 1. Figure 2(a) shows the real and imaginary parts of the scattering length $a = \alpha - i\beta$ for two Rb atoms as functions of dc magnetic field for different rf field amplitudes. The elastic and inelastic cross sections can be evaluated from a as $\sigma_{\rm el} = 8\pi(\alpha^2 + \beta^2)$ and $\sigma_{\rm inel} = 8\pi\beta/k_i$ [1]. At zero rf field, the resonance occurs at $B = 9.15$ G, in good agreement with the experimental results of 9.09±0.01 G [26] and 9.12(9) G [27]. As shown in Fig. 2, an external rf field shifts the resonance to higher magnetic fields without affecting its width. The magnitude of the shift increases quadratically with increasing rf amplitude. An expanded view of the encircled area in Fig. 1 presented in Fig. 2(c) illustrates that off-resonant rf fields modify both atomic thresholds and molecular bound states, thereby altering the positions of avoided crossings and Feshbach resonances. The shifts arise due to virtual exchange of rf photons between different atomic hyperfine states, which modifies the atomic g-factors [22]. The ABM overestimates the resonance position by 0.15 G, but accurately reproduces the rf-induced resonance shift.

An interesting possibility suggested by recent experimental work [18] is to use rf fields to directly couple a two-atom scattering state with a bound molecular state. This coupling would lead to a Feshbach resonance whose properties depend on the parameters of the rf field. As shown in Fig. 1, six of 15 low-lying molecular states can be accessed from the continuum by scanning the rf frequency from 18 to 24 MHz. The other 11 states remain uncoupled from the initial state $|1,1\rangle \otimes |2,-1\rangle$ due to the selection rules $\Delta n = \pm 1$ and $\Delta m_F = \mp 1$ imposed by Eq. (2). Figure 3(a)-(b) show the rf frequency dependence of the cross sections for two Rb atoms in the $|1,1\rangle \otimes |2,-1\rangle$ state at a magnetic field of 2 G. The scattering length exhibits a number of sharp peaks at rf frequencies corresponding to the bound levels A-F in Fig. 1. The widths of the resonances increase with increasing rf amplitude. As shown in Fig. 3(c)-(d), rf-induced Feshbach resonances can also occur in collisions of atoms initially in the *low-field-seeking state* $|1,-1\rangle \otimes |2,1\rangle$.

In order to understand the mechanism of rf-induced Feshbach resonances, we use a three-state model developed by Bohn and Julienne [28] and illustrated in Fig. 4. The rf field couples the incident channel $|i,N\rangle$ to the field-dressed bound state $|b,N+1\rangle$ with energy $\epsilon_b + \hbar\omega$, where ϵ_b is the binding energy of the molecular state in the absence of an rf field. The bound state $|b,N+1\rangle$ is coupled to an open channel $|a,N+1\rangle$ by the spin-dependent interaction potential (1). Introducing the matrix elements $\gamma_{ib} = 2\pi|\langle i,N|\hat{H}_{\rm A}+\hat{H}_{\rm B}|b,N+1\rangle|^2$