

1 →

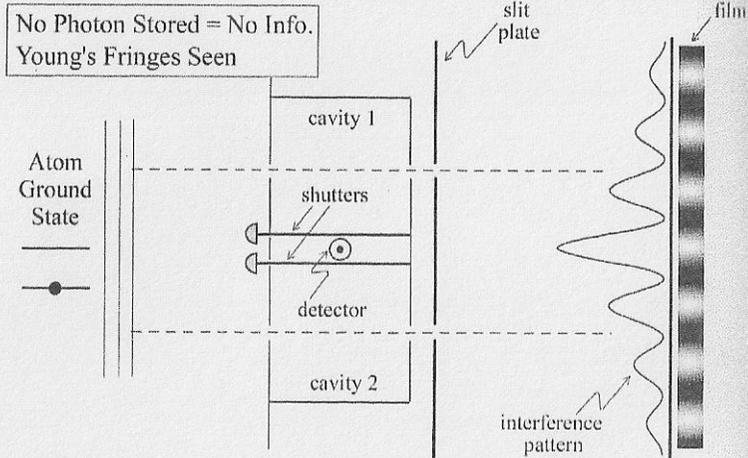


Fig. 9.3 Here we're using a ground-state atom. Thus, it cannot leave a photon in the cavity, so there is no tell-tale photon. Hence, this experiment cannot yield which-path information, and so we have interference fringes on the detection screen. The interference fringes are indicated as a bright-dark pattern (on the film) and the number of counts is sketched as the usual interference pattern.

2 →

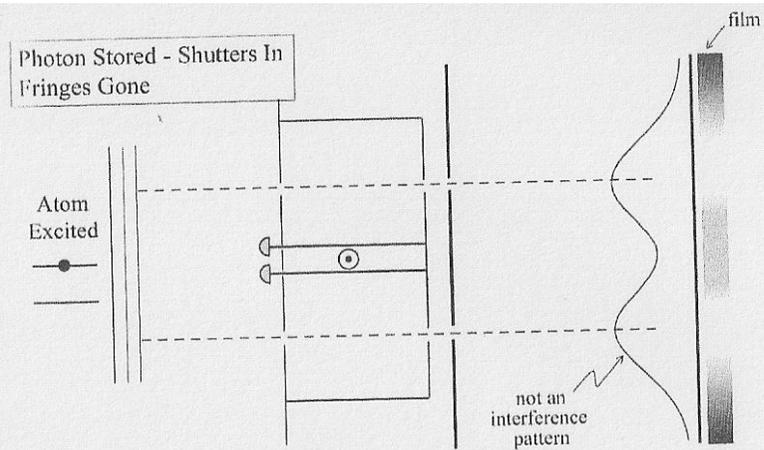


Fig. 9.4 This is the same as Fig. 9.3, except that now we are using an atom in the excited state. Because the atom now leaves a photon in the top or bottom cavity, which-path information is available – if we only open a shutter. But we're not going to in this case. Nevertheless, the *availability* of which-

path information rubs out interference fringes. On the detection screen we see two humps – the group of atoms traveling in a straight line from the top cavity gives the top hump, and the group from the bottom cavity gives the bottom hump.

3 →

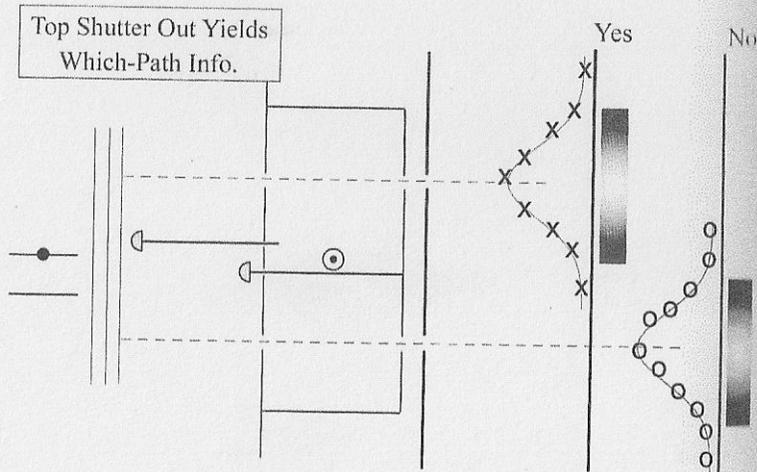


Fig. 9.5 Now we work the shutters. Suppose the top shutter is opened after the atom has passed. Each time we mark the corresponding result on the detection screen. If the photodetector clicked, this means that the atom took the top path and we mark the spot on

the screen with a cross. If we get no click, the atom went through the bottom cavity. We mark these spots on the screen with a circle. We have which-path information, and therefore no interference fringes.

4 →

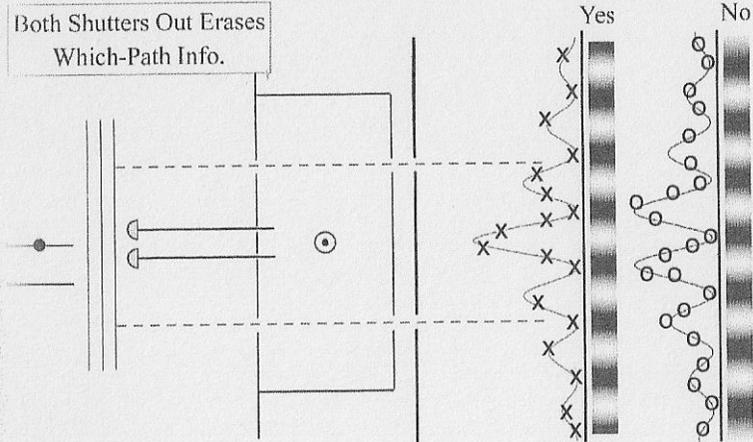


Fig. 9.6 What's different here? We have removed or opened both shutters. In removing or opening both shutters, we have erased potential which-path information (information we could have had). Now consider events on the detection screen or film – the fringes return if we correlate counts on the screen with clicks in the (eraser) detector. If we get a click, the tell-tale

photon was erased and we mark the corresponding spot where the atom hits the screen with a cross. If we do not get a click, even though both shutters are out (and this will be the case half of the time), we mark the spot on the screen with a circle. The collection of circles on the screen will be an interference pattern shifted with maxima and minima as indicated.

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