

- Additional notes on changing variables with distributions

- Sometimes we need to do a change of variables
 - + Going to spherical coordinates and/or a "reduced distribution"
 - + Changing reference frames, etc.

- The key thing to remember is that the integrals have to be the same.

+ Let $f(Q)$ be the old distribution in the old variables
and $g(q)$ be the new distribution in the new ones

+ Then
$$\int dQ f(Q) = \int dq g(q)$$

+ This means $g(q) = f(Q) \left| \frac{dQ}{dq} \right| \leftarrow$ Jacobian

(and you get rid of extra variables)

+ For example, when we talk about the angular distribution,

$$\int d^2\Omega f(\theta, \phi) = \int d^3\vec{p} f(\vec{p}) = \int d^2\Omega \int_0^\infty dp p^2 f(\vec{p})$$

So there is a p^2 involved

+ Another example. If you change from frame S to S' ,

$$\int d^3\vec{x} d^3\vec{p} f(\vec{x}, \vec{p}) = \int d^3\vec{x}' d^3\vec{p}' f(\vec{x}', \vec{p}')$$

You must include any factors from the change of variables