The extinction paradox

But there is something very strange about the extinction efficiency. Notice that for big particle $Q_e \approx 2$. How is this possible?! This is effectively saying that the geometric cross-section of an object extinguishes twice as much radiation as every day experience tells us it should. Strange, but nonetheless true. Looking at an object close, of course it only extinguishes as much incident radiation as is incident on its cross-section. But fire that object far away, and illuminate it from behind, and it extinguishes twice as much. This is because light is diffracted around the object, even if it is not directly incident on it. In the far field (i.e. much farther from the object than the object is wide), the amount of light diffracted by the object is equivalent to the size of the object itself. This radiation is removed from the direct beam - even if it is bent ever so slightly - so the object gets to remove radiation twice - the radiation directly incident on the object, plus the radiation diffracted around the object. We don’t see this effect in everyday life, because we are unable to resolve with our eyes the tiny angular deviation involved in diffraction. We can just pick it out as blurriness between the teeth of a comb or by holding your fingers close together. Diffraction occurs all over nature though. Examples are hearing noises around a corner, or water waves diffracting around the corner of a dock.