

$$S^2 \subset \mathbb{R}^3, \quad S^1 = \mathbb{R}/2\pi\mathbb{Z}$$

$$p_n: S^1 \longrightarrow SO(3) \quad n \in \mathbb{Z}$$

$$t \longmapsto \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(ut) & -\sin(ut) \\ 0 & \sin(ut) & \cos(ut) \end{pmatrix}$$

$$X_n := D^2 \times S^2 \cup_{p_n} D^2 \times S^2$$

Ex: (a)  $X_n$  is a 4-manifold

$$(b) \pi_2(X_n) \neq 0$$

$$(c) X_n \stackrel{co}{\cong} \begin{cases} S^2 \times S^2 & ; n \text{ even} \\ \mathbb{C}P^2 \# (-\mathbb{C}P^2) & ; n \text{ odd} \end{cases}$$