$$\Lambda = \{ m_1 \Pi_1 + \cdots + m_{2g} \Pi_{2g},\ m_i \in \mathbb{Z} \}$$

in $\mathbb{C}^g$; we define the Jacobian variety $J(S)$ of S to be the complex torus $\mathbb{C}^g/\Lambda$. The Jacobian is a natural range for Abelian integrals: whereas the integral $\int_p^q \omega$ of a single holomorphic differential ω is defined only modulo the $2g$ periods of ω, which are usually dense in $\mathbb{C}$, the vector

$$\left(\int_p^q \omega_1, \cdots \int_p^q \omega_g \right),$$

is well-defined as a vector in $\mathbb{C}^g$ modulo the discrete lattice $\Lambda \subset \mathbb{C}^g$.

"which are usually dense in $\mathbb{C}$"

$$\left\{ \int_{\delta_1} \omega, \int_{\delta_2} \omega, \cdots \int_{\delta_{2g}} \omega \right\} \subset \mathbb{C} \text{ should be discrete.}$$

Picking a base point $p_0 \in S$, accordingly, we have a natural map

$$\mu : S \longrightarrow J(S)$$

given by

$$\mu(p) = \left(\int_{p_0}^p \omega_1, \cdots \int_{p_0}^p \omega_g \right) \in J(S).$$

More generally, if $Div^0(S)$ denotes the group of divisors of degree 0 on S, we define $\mu : Div^0(S) \rightarrow J(S)$ by

$$\mu\left(\sum p_\lambda - \sum q_\lambda\right) = \left(\sum \int_{q_\lambda}^{p_\lambda} \omega_1, \cdots \sum \int_{q_\lambda}^{p_\lambda} \omega_g \right).$$