

# Hodge Theory

Victor Guillemin

Notes, Spring 1997

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## 1 Definition and properties of $\star$ .

Let  $V$  be an  $n$ -dimensional vector space over  $\mathbf{R}$  and  $B$  a bilinear form on  $V$ .  $B$  induces a bilinear form on  $\wedge^p V$ , also denoted by  $B$  determined by its value on decomposable elements as

$$B(\mu, \nu) := \det(B(u_i, v_j)), \quad \mu = u_1 \wedge \cdots \wedge u_p, \quad \nu = v_1 \wedge \cdots \wedge v_p.$$

Suppose we also have fixed an element  $\Omega \in \wedge^n V$  which identifies  $\wedge^n V$  with  $\mathbf{R}$ . Exterior multiplication then identifies  $\wedge^{n-p} V$  with  $(\wedge^p V)^*$  and  $B$  maps  $\wedge^p V \rightarrow (\wedge^p V)^*$ . We thus get a composite map

$$\star : \wedge^p V \rightarrow \wedge^{n-p} V$$

# Notes On Gauge Theory And Hodge Theory

**Kenji Ueno, Yūji Shimizu**



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