# 4 Percent of Laura's Dissertation

Laura Taalman, A.B.D.

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\begin{tikzcd}
\mathcal{N}(Z-E) \arrow[r, hook, "\alpha"] \arrow[d] & \mathcal{I}_E\Omega^1(\log E) \arrow[r, hook, "="'] \arrow[d] & \mathcal{I}_E\Omega^1(\log E) \arrow[d, "\wedge\frac{dh}{h}", "\widetilde{\beta}"'] \arrow[dr, "\beta"] & \\
\underbrace{\textstyle\bigwedge^2\mathcal{N}(2Z-E)\otimes\mathcal{O}(R)}_{\bigwedge^2\mathcal{N}(Z-E)} \arrow[r, hook, "\alpha_2"] \arrow[d] & \underbrace{\mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(Z-N+R)}_{\mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(-N)\otimes\mathcal{O}(-N)} \arrow[r, hook] \arrow[d] & \mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(R) \arrow[r, two heads, "p_2"] \arrow[d, two heads, "\wedge\frac{dh}{h}", "\widetilde{\gamma}"'] & \underbrace{\mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(R)\Big/\textstyle\bigwedge^2\mathcal{N}(2Z-E)\otimes\mathcal{O}(R)}_{\left(\Omega^2(\log E)\big/\bigwedge^2\mathcal{N}(2Z)\right)\otimes\mathcal{O}(-Z-E)} \arrow[d, "\gamma"] \\
\underbrace{\textstyle\bigwedge^3\mathcal{N}(3Z-E)\otimes\mathcal{O}(2R)}_{\bigwedge^3\mathcal{N}(Z-E)} \arrow[r, hook, "\approx", "\alpha_3"'] & \underbrace{\mathcal{I}_E\Omega^3(\log E)\otimes\mathcal{O}(2Z-P-N+2R)}_{\Omega^3\otimes\mathcal{O}(-P-N)} \arrow[r, hook] & \underbrace{\mathcal{I}_E\Omega^3(\log E)\otimes\mathcal{O}(2R)}_{\Omega^3\otimes\mathcal{O}(2R)} \arrow[r, two heads, "p_3"] & \underbrace{\mathcal{I}_E\Omega^3(\log E)\otimes\mathcal{O}(2R)\Big/\textstyle\bigwedge^3\mathcal{N}(3Z-E)\otimes\mathcal{O}(2R)}_{\Omega^3\otimes\mathcal{O}_{P+N-2Z}(-2Z)}
\end{tikzcd}
$$

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\begin{tikzcd}
\mathcal{N}(Z-E) \arrow[r, hook, "\alpha_1"] \arrow[d] & \mathcal{I}_E\Omega^1(\log E) \arrow[r, equal] \arrow[d] & \mathcal{I}_E\Omega^1(\log E) \arrow[d, "\widetilde{\beta}"', "\wedge\frac{dh}{h}"] \arrow[dr, "\beta"] & \\
\bigwedge^2\mathcal{N}(2Z-E)\otimes\mathcal{O}(R) \arrow[r, hook, "\alpha_2"] \arrow[d] & \mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(Z-N+R) \arrow[r, hook] \arrow[d] & \mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(R) \arrow[r, two heads, "p_2"] \arrow[d, "\widetilde{\gamma}"', "\wedge\frac{dh}{h}"] & \mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(R)\big/\bigwedge^2\mathcal{N}(2Z-E)\otimes\mathcal{O}(R) \arrow[d, "\gamma"] \\
\bigwedge^3\mathcal{N}(3Z-E)\otimes\mathcal{O}(2R) \arrow[r, hook, "\alpha_3", "\approx"'] & \mathcal{I}_E\Omega^3(\log E)\otimes\mathcal{O}(2Z-P-N+2R) \arrow[r, hook] & \mathcal{I}_E\Omega^3(\log E)\otimes\mathcal{O}(2R) \arrow[r, two heads, "p_3"] & \mathcal{I}_E\Omega^3(\log E)\otimes\mathcal{O}(2R)\big/\bigwedge^3\mathcal{N}(3Z-E)\otimes\mathcal{O}(2R)
\end{tikzcd}
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**a.k.a.**

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\begin{tikzcd}
\mathcal{N}(Z-E) \arrow[r, hook, "\alpha_1"] \arrow[d] & \mathcal{I}_E\Omega^1(\log E) \arrow[r, equal] \arrow[d] & \mathcal{I}_E\Omega^1(\log E) \arrow[d, "\widetilde{\beta}"', "\wedge\frac{dh}{h}"] \arrow[dr, "\beta"] & \\
\bigwedge^2\mathcal{N}(Z-E) \arrow[r, hook, "\alpha_2"] \arrow[d] & \mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(-N) \arrow[r, hook] \arrow[d] & \mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(R) \arrow[r, two heads, "p_2"] \arrow[d, "\widetilde{\gamma}"', "\wedge\frac{dh}{h}"] & \left(\Omega^2(\log E)\big/\bigwedge^2\mathcal{N}(2Z)\right)\otimes\mathcal{O}(-Z-E) \arrow[d, "\gamma"] \\
\bigwedge^3\mathcal{N}(Z-E) \arrow[r, hook, "\alpha_3", "\approx"'] & \Omega^3\otimes\mathcal{O}(-P-N) \arrow[r, hook] & \Omega^3\otimes\mathcal{O}(2R) \arrow[r, two heads, "p_3"] & \Omega^3\otimes\mathcal{O}_{P+N-2Z}(-2Z)
\end{tikzcd}
$$

**so we have**

$$
\mathcal{N}(Z-E) \xhookrightarrow{\alpha_1} \mathcal{I}_E\Omega^1(\log E) \xrightarrow[\wedge\frac{dh}{h}]{\beta} \mathcal{I}_E\Omega^2(\log E)\otimes\mathcal{O}(R) \xrightarrow[\wedge\frac{dh}{h}]{\gamma} \Omega^3\otimes\mathcal{O}_{P+N-2Z}(-2Z)
$$